

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT			1. CONTRACT ID CODE N/A	PAGE 1 OF 123 PAGES
2. AMENDMENT/MODIFICATION NO. 0002	3. EFFECTIVE DATE 5 SEP 03	4. REQUISITION/PURCHASE REQ. NO. N/A		5. PROJECT NO. (If applicable)
6. ISSUED BY CODE		7. ADMINISTERED BY (If other than Item 6) CODE		
DEPARTMENT OF THE ARMY CORPS OF ENGINEERS SACRAMENTO 1325 J STREET SACRAMENTO, CALIFORNIA		SEE ITEM 7		

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)		(✓)	9A. AMENDMENT OF SOLICITATION NO. DACW07-03-B-0006
		×	9B. DATED (SEE ITEM 11) 1 AUG 2003
			10A. MODIFICATION OF CONTRACTS/ORDER NO. N/A
			10B. DATED (SEE ITEM 13) N/A
CODE	FACILITY CODE		

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☒ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

(✓)	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)
UPGRADE OF MAINLINE RAILROAD SYSTEM, PETALUMA MAINLINE RAILROAD APPROACH, PETALUMA RIVER
SONOMA COUNTY, CALIFORNIA

2 ENCLS 1) APPENDICES (122 PAGES).

2) DRAWING SHEETS 6 & 9.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY (Signature of Contracting Officer)	16C. DATE SIGNED

**NORTHWESTERN PACIFIC RAILROAD AUTHORITY
APPLICATION FOR ENCROACHMENT**

PROJECT TITLE: _____

PROJECT LOCATION: _____

PROJECT PURPOSE: _____

DESCRIPTION OF STRUCTURE TO BE PLACED ON PROPERTY: _____

APPLICANT: _____ Telephone: _____

ADDRESS: _____ Facsimile: _____

CONTACT PERSON: _____

TERM DESIRED: _____

Applicant agrees to occupy and use the encroachment, if granted, in accordance with all rules, regulations, and restrictions imposed by Northwestern Pacific Railroad Authority (Authority). Applicant agrees to maintain and repair, at its sole cost and expense, all improvements placed or constructed on the property and to keep the property free from debris and in a condition acceptable to Authority. Applicant further agrees to reimburse Authority for Authority's actual costs and expenses for processing this application, preparing the encroachment agreement and other related documents and overseeing the placement or construction of improvements to the property.

1. Are any of applicant's improvements currently located on the property?

Yes ____ No ____ If yes, explain: _____

2. Are there existing circumstances that could change applicant's use of the property?

Yes ____ No ____ If yes, explain: _____

3. Are there any special circumstances involving applicant's request?

Yes ____ No ____ If yes, explain: _____

This application, including the applicant fee in the amount of \$250.00.

(\$_____), is submitted this _____ day of _____

_____ (year).

Applicant Organization: _____

Applicant Signature: _____

Printed Applicant Name: _____

Printed Applicant Title: _____

FOR NWPRRA USE ONLY

MP:

ESTIMATED COSTS & EXPENSES:

PROJECT NUMBER:

SPECIAL DESIGNATION:

Northwestern Pacific Railroad Authority

Terms of standard Right-of-Entry Permit

Permit is only for the purpose specifically applied for.

Term of Permit is for a maximum of one year, unless otherwise requested by Permittee and approved by Permittor.

Permittee may not assign its rights under this License.

Permittee shall provide falsework, shoring, security persons, inspectors, flaggers, and/or traffic control if so required by Permittor.

Permit is terminable by either Permittee or Permittor upon 30 days' written notice to the other party.

Permittor must approve construction plans and schedules.

Permittee must notify Northwestern Pacific Railroad at least 10 days before commencing any work on right-of-way.

Permittee must maintain the following minimum clearances when working on track:

- a. 25'-0" horizontally from centerline of track; and
- b. 22'-6" vertically above top of rail.

Hazardous materials shall not be used or stored on railroad property except in such small amounts such as may be necessary to perform the work.

Permittee to indemnify and name as Insureds Permittor and Permittor's member agencies (namely: Golden Gate Bridge, Highway and Transportation District, County of Marin, and North Coast Railroad Authority). Insurance required:

- a. Workers' Compensation and Employers' Liability Insurance:
\$2 million
- b. Personal Injury and Property Damage Liability Insurance:
\$5 million
- c. Railroad Protective Liability Insurance:
\$2 million per occurrence
\$5 million annual aggregate
coverage to include injury, death, property loss or damage.

Permit fee: \$500

Permittee also agrees to pay costs of Permittor to review application.

FOR NWPRRA USE ONLY

Date

RIGHT-OF-ENTRY PERMIT

NORTHWESTERN PACIFIC RAILROAD AUTHORITY ("Permitter") hereby permits _____ ("Permittee"), (Address) _____ to enter upon Permitter's property located at _____, in _____, County of _____, California, near Mile Post _____, as described in the attached Exhibit A _____ ("Premises"), which _____ incorporated by this reference, subject to all existing licenses, easements, encumbrances, and claims of title affecting Premises and upon the following terms and conditions:

1. Permit. No work shall commence on Premises until Permittee accepts this permit ("Permit"). The doing of any work under this Permit shall constitute acceptance of these Permit provisions.
2. Exclusive Use. This Permit is for Permittee's exclusive use and is not assignable without the prior consent of Permitter.
3. Purpose. The permitted purpose of Permit shall be solely for entry upon Premises for _____

at _____, California, near Mile Post _____, including bringing all necessary personnel and equipment onto Premises as necessary for the permitted purpose ("Project").
4. Term. This Permit shall be effective at such time as the fees identified in Section 6 have been paid and shall continue until _____, and then shall automatically terminate unless extended by mutual written agreement. If the fees are not received within fifteen (15) days from the date

of this Permit, then Permit shall be null and void.

Permittor reserves the right to revoke or modify this Permit at any time prior to the termination date upon forty-eight (48) hours advance notice from Permittor to Permittee.

If Permittee requires use of Premises prior or subsequent to the foregoing dates, then Permittee shall request approval from Permittor at least forty-eight (48) hours prior to the time requested. Permittee shall pay additional fees as set forth in Section 6 below for such additional use.

5. Permit Shall Remain On-Site. A copy of this Permit must be kept on the site of Premises at all times during the term of this Permit and shall be shown to any representative of Permittor upon demand. Project may be suspended if this Permit is not at Premises.
6. Permit Fees and Costs. As compensation for use of Premises, Permittee shall pay the costs for review of Permit application, design and construction plans, preparation of Permit, and any inspection of activity or construction authorized by this Permit, including but not limited to, expenses incurred by Permittor, which costs and expenses Permittee shall pay upon demand. Permittee shall pay to Permittor upon execution hereof the sum of Five Hundred Dollars (\$500.00), which is an estimate of such costs and expenses.
7. Project Plan. Project shall be performed in accordance with a plan identifying the sequence of operations, schedules and locations for said Project. The plan shall be submitted to Permittor in advance of any work for Permittor's approval and such work shall be subject to monitoring and inspection by Permittor.
8. Cost of Work, Protection of Traffic, and Working Procedures. All costs related to Permittee's operations upon Premises shall be at Permittee's expense. All work upon or in connection with the use of Premises shall be done at such times and in such manner as not to interfere with the current or future use of Premises. Permittee shall be responsible for the provision of barriers, directions, signage, and other forms of notice to the general public to assure the safe, smooth, and uninterrupted flow of traffic around Project site and on and about Premises. Permittee shall keep Permittor's Premises in a reasonably neat and safe condition failing which Permittor, after twenty-four (24) hours prior notice to Permittee, may do so at Permittee's expense.

Permittee shall comply with the regulations of the instructions of Permittor's representatives relating to the proper manner of protecting the tracks, pipelines, wire lines, signals, and all other property at said location, the traffic moving on such tracks, and the removal of tools, equipment, and materials.

All work by Permittee upon Premises shall be performed in a good and worker-like manner satisfactory to Permittor. Since there is the possibility of the existence of pipelines or other structures beneath Premises, if Permittee should excavate or drill, then Permittee's forces shall explore such structures with hand tools to a depth of at least eight feet (8') below the surface of the ground or, at Permittee's option, use suitable detection equipment prior to drilling or excavating with mechanized equipment. Absence of markers does not constitute a warranty by Permittor of no subsurface installations. It shall be Permittee's responsibility to determine the existence of any underground facilities and Permittee shall call Underground Service Alert at 1 (800) 642-2444 prior to beginning any work on the property.

Permittee shall telephone Qwest Communications, Inc., at 1 (800) 283-4237 (a 24-hour number) to determine whether a telecommunications system is buried anywhere on the property. If there is, Permittee shall telephone the owner of the system designated by Permittor, arrange for a cable locator and make arrangements for relocation or other protection for the system prior to beginning any work on the property.

Any open holes shall be satisfactorily covered at all times when Permittee's forces are not physically working in the actual vicinity. Upon completion of work, all holes will be filled in to meet the surrounding ground level with clean, compacted, earthen material and the property left in a neat and safe condition reasonably satisfactory to Permittor.

Permittee agrees to reimburse Permittor for the cost and expense to Permittor of furnishing any materials or performing any labor in connection with the use of Premises, including, but not limited to, the installation and removal of such false work and other protection beneath or along the railroad tracks, and the furnishing of such security persons, flaggers, and inspectors as Permittor deems necessary. Prior to incurring any cost or expense, Permittor shall reasonably notify Permittee of the same. Said reimbursement shall be paid by Permittee to Permittor within thirty (30) days after presentation of a bill.

Permittee shall fully pay for all materials joined or affixed to Premises, and shall pay in full all persons who perform labor on Premises. As Permitter is a public entity, its property is not subject to mechanics' or materialmen's liens, and nothing in this Permit shall be construed to make its property subject to such liens. However, if any such liens are filed, Permittee shall immediately remove them at Permittee's own expense, and shall pay any judgment which may be entered. Should Permittee fail, neglect, or refuse to do so, Permitter, after 48 hours prior notice to Permittee, shall have the right to pay any amount required to release any such liens, or to defend any action brought, and to pay any judgment entered. Permittee shall be liable to Permitter for all costs, damages, reasonable fees, and any amounts expended in defending any proceedings or in the payment of any of said liens or any judgment. Permitter may post and maintain upon Premises notices of non-responsibility as provided by law.

Permittee shall cooperate with Permitter in making any tests Permitter requires of any installation or condition which in Permitter's reasonable judgment may have an adverse effect on any of the facilities of Permitter. All costs incurred by the tests, or any corrections required as a result of such tests, shall be borne by Permittee.

Permittee shall take protective measures necessary to keep Permitter's facilities, including track ballast, free of sand or debris resulting from its use of Premises. Should any damage occur to Permitter's facilities as a result of Permittee's use of Premises, Permittee shall immediately notify Permitter and Operator. Current operator is Railways, Inc. and may be contacted at (707) 444-8025. Any damage to Permitter's facilities resulting from Permittee's use of Premises will be repaired or replaced by Permitter at Permittee's sole cost and expense, which Permittee shall pay to Permitter promptly upon demand.

9. No Crossing of Tracks. Permittee shall not be permitted to cross Permitter's tracks located near Premises but shall gain access to and from Premises only by use of designated public streets.
10. No Hazardous Materials. No hazardous materials shall be handled at any time upon Premises.
11. Mechanized Equipment. Under no condition shall Permittee be permitted to place or store any mechanized equipment, tools or other materials within twenty-five feet (25') of the center line of Permitter's nearest railroad tracks.

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12. Indemnity and Insurance. Permittee shall release, defend (with counsel reasonably satisfactory to Permitter) and indemnify Permitter, Permitter's member agencies (namely, Golden Gate Bridge, Highway and Transportation District, County of Marin, and North Coast Railroad Authority), Union Pacific Railroad, the successors and assigns of any of them, any railroad company operating on Premises, and their respective directors, officers, employees, and agents (collectively, "Indemnitees") from and against all liability, cost, and expense for loss of, or damage to, property and for injuries to, or death of, any person (including, but not limited to, the property and employees of each party) when arising or resulting from the use of Premises by Permittee, its agents, employees, contractors, subcontractors, or invitees; or Permittee's breach of these provisions. ~~This indemnity shall encompass any liability arising out of violations of Civil Code §3344.~~ The duty of Permittee to indemnify and save harmless the Indemnitees includes the duties to defend as set forth in Section 2778 of the Civil Code. It is the express intent of the parties under this Section 12, that Permittee will indemnify and hold harmless the Indemnitees from any and all claims, suits, or actions arising from any cause whatsoever as set forth above, other than the active negligence, wilful misconduct, or criminal acts of the Indemnitees. Permittee waives any and all rights to any type of express or implied indemnity against the Indemnitees arising out of Permittee's use of or activities on Premises. This indemnity shall survive termination of this Permit. It is the intention of the parties that should any term of this indemnity provision be found to be void or unenforceable, the remainder of the provision shall remain in full force and effect.

Prior to entry upon Premises, Permittee shall provide Permitter with satisfactory evidence, in the form of a Certificate of Insurance, that Permittee is insured in accordance with the following, which insurance shall remain in effect throughout the term of this Permit:

- a. Workers' Compensation and Employers' Liability Insurance. Permittee shall procure and maintain Workers' Compensation Insurance and Employers' Liability Insurance in accordance with the laws of the State of California. Employers' Liability Insurance shall have coverage for a minimum liability of Two Million Dollars (\$2,000,000) covering Permittee's employees engaged in the work. Permittee shall insure the procurement and maintenance of such insurance by all contractors or subcontractors engaged on Project.

Prior to commencement of any work hereunder, Permittee shall deliver to Permittor a Certificate of Insurance which shall stipulate that thirty (30) days advance written notice of cancellation or non-renewal shall be given to Permittor.

- b. Personal Injury and Property Damage Liability Insurance. Permittee shall also procure and maintain Personal Injury and Property Damage Liability Insurance, including, but not limited to, what is commonly referred to as coverage for "XCU Hazards" (Explosion, Collapse, and Underground Property Damage) which shall include as additional insureds Permittor, Permittor's member agencies (namely, Golden Gate Bridge, Highway and Transportation District, County of Marin, and North Coast Railroad Authority), Union Pacific Railroad, the successors and assigns of any of them, any railroad company operating on Premises, and their respective directors, officers, employees and agents (collectively, "Insureds"), as they now or as they may hereafter be constituted, singly, jointly, or severally. Such insurance shall include Automobile Bodily Injury and Property Damages coverage including owned, hired, and non-owned vehicles.

Said insurance shall be subject to a combined single limit of liability of not less than Five Million Dollars (\$5,000,000).

- c. Railroad Protective Liability Insurance. The Licensee shall provide, with respect to the operations it or any of its subcontractors perform above the railroad tracks or within fifty feet (50') horizontally of the railroad tracks, Railroad's Protective Liability Insurance with the Insurance Services Offices/Railroad Insurance Management Association (ISO/RIMA) form with pollution coverage for job site fuels and lubricants. The Licensee shall be the named insured and said policy shall cover all other railroads operating on the right-of-way. The policy shall have limits of liability of not less than Two Million Dollars (\$2,000,000) per occurrence, combined single limit, for losses arising out of injury to or death of all persons, and for physical loss or damage to or destruction of property, including the loss of use thereof. Prior to commencing work or entering onto the property, Licensee shall file the original of the policy for Railroad Protective Liability with the Licenser.

Prior to entering onto Premises, Permittee shall file Certificate(s) of Insurance with Permittor evidencing the required coverage and endorsement(s) and upon request, a

certified duplicate original of any of those policies. Said Certificate(s) shall stipulate:

- 1) The insurance company(ies) issuing such policy(ies) shall give written notice to Permittor of any material alteration, cancellation, non-renewal, or reduction in aggregate limits, if such limits apply, and provide at least thirty (30) days notice of cancellation.
- 2) That the policy(ies) is Primary Insurance and the insurance company(ies) providing such policy(ies) shall be liable thereunder for the full amount of any loss or claim which Permittee is liable for under Sections 12 and 13, up to and including the total limit of liability, without right of contribution from any other insurance effected or which may be effected by the Insureds.
- (3) The policy shall also stipulate: Inclusion of the Insureds as additional insureds shall not in any way affect its rights either as respects any claim, demand, suit or judgment made, brought or recovered against Permittee. Said policy shall protect Permittee and the Insureds in the same manner as though a separate policy had been issued to each, but nothing in said policy shall operate to increase the insurance company's liability as set forth in its policy beyond the amount or amounts shown or to which the insurance company would have been liable if only one interest had been named as an insured.

The insurance policy(ies) shall be written by an insurance company or companies acceptable to Permittor. Such insurance company shall be authorized to transact business in the state of California.

13. Permits from Other Agencies; Hazardous Materials. Permittee shall comply, at Permittee's expense, with all applicable laws, regulations, rules and orders with respect to the use of Premises, and shall obtain all required licenses, permits or other approvals in connection with Permittee's use of Premises. Permittee shall furnish satisfactory evidence of such compliance upon request of Permittor.

Should any discharge, leakage, spillage, emission or pollution of any type occur upon or from Premises due to Permittee's use and occupancy thereof, Permittee, at Permittee's expense,

shall clean all affected property to the satisfaction of Permittor and any governmental body having jurisdiction.

Permittee shall indemnify, hold harmless and defend the Indemnitees against all liability, cost, and expense (including, without limitation, any fines, penalties, judgments, litigation costs, reasonable attorneys' fees and consulting, engineering and construction costs) incurred by Permittor as a result of Permittee's breach of this section or as a result of any such discharge, leakage, spillage, emission, or pollution by Permittee, regardless of whether such liability, cost, or expense arises during or after the term of this Permit.

14. Assumption of Risk. Permittee shall assume all risk of damage to any and all other property of Permittee, or any property under the control or custody of Permittee while upon or near Premises of Permittor incident to the use of Premises; provided, however, such assumption by Permittee shall not include any damage caused by the active negligence and/or willful misconduct of Permittor. Permittee releases Permittor from any liability, including claims for damages or extra compensation, arising from construction delays due to transportation activities by Permittor or transportation operations by any agency as authorized by Permittor.
15. Subcontractors. Any person, firm or corporation Permittee authorizes to work upon Premises, including any contractor(s) and subcontractor(s), shall be deemed to be Permittee's agent and shall be subject to all the applicable terms hereof.
16. Restoration of Premises. Upon termination of this Permit, Permittee, at its own expense, shall remove from Premises all property it owns or controls, all debris and other materials, and restore Premises to its condition prior to entry or to a condition reasonably satisfactory to Permittor. Upon Permittee's failure to do this, Permittor, upon forty-eight (48) hours prior notice to Permittee, may perform such work at Permittee's expense.
17. Severability. If any provision of this Permit shall be for any reason unenforceable, in any respect, such unenforceability shall not affect the other provisions of this Permit.
18. Attorneys' Fees. If any legal proceeding should be instituted by either of the parties to enforce the terms of this Permit or to determine the rights of the parties under this Permit, the prevailing party in the proceeding shall receive, in addition to all court costs, reasonable attorneys' fees.

Northwestern Pacific Railroad Authority
Right-of-Entry Permit

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If the endorsed copy of this Permit is not received within fifteen (15) days from the date of this Permit, then this Permit shall be null and void.

IN WITNESS WHEREOF, the parties have executed this Permit as of the day and year first above written by their duly authorized representatives.

**NORTHWESTERN PACIFIC
RAILROAD AUTHORITY**

Permittee: _____

By: _____
Carney J. Campion
Executive Director

By: _____
Title: _____

ATTEST:

By: _____
Title: _____

*By: _____
Title: _____

APPROVED AS TO FORM:

Incorporated under the laws of
State of _____

Attorney for the Authority

* If Permittee is a corporation, two corporate officers must sign on behalf of the corporation as follows: 1) the chairman of the board, president or vice president; and 2) the secretary; assistant secretary, chief financial officer or assistant treasurer.

EXHIBIT A

EXHIBIT B

CONTRACTOR GENERAL SAFETY REQUIREMENTS

Presented to protect the employers and employees of all outside contractors or other entities that will be working in or about the right of way of the Northwestern Pacific

Safety is of prime importance in performing any of the service under contract with the Northwestern Pacific. The railroad does not in any manner assume the control or responsibility of the Contractor, or other outside entity, to provide safe working conditions for the Contractor's employees or subcontractors in requiring the Contractor, or other outside entity, to the railroad's general safety requirements. The Contractor, or other outside entity, is responsible for compliance with Federal and State laws and any government regulations, including those related to Track Work Protection when work is conducted around tracks. **Additionally, the Contractor, or other outside entity, is responsible for ensuring all State and Federal Safety Regulations are followed for all construction operations. These governing agencies will include, but are not limited to, the FRA (Federal Railroad Authority) and OSHA (Occupational Safety & Health Administration).**

Work in the proximity of a railroad track is potentially dangerous. The Contractor, or other outside entity, and its employees, subcontractors and invites are governed by the following Safety Rules and General Safety Requirements while on railroad property. The Contractor, or other outside entity, is responsible for enforcement of these rules and requirements. The railroad has the right to bar the Contractor, or other outside entity, its employees, subcontractors and invitees from working on railroad property if the railroad deems such persons are acting in an unsafe manner.

Safety rules cannot be all-inclusive. Workers must refrain from unsafe and improper practices, including both the violation of written rules and regulations, and rules of common sense.

1. The use of alcoholic beverages, intoxicants, narcotics, marijuana or other controlled substances by employees subject to duty or their possession or use while on duty or on railroad property is prohibited. Workers must not report for duty under the influence of any alcoholic beverage, intoxicant, narcotic, marijuana or other controlled substance, or medication, including those prescribed by a doctor, that may in any way adversely affect their alertness, coordination, reaction, response or safety.
2. Scuffling, horseplay, practical jokes and all conduct of a similar nature is prohibited.
3. All vehicle accidents resulting in damage to railroad property will be reported immediately to the Chief Engineer of the Northwestern Pacific.
4. All persons are prohibited from having firearms or other deadly weapons, including knives with a blade in excess of three inches, in their possession while on duty or on railroad property, except those authorized to have them in the performance of their duties or those given special permission.
5. Good housekeeping is of the utmost importance in the prevention of accidents, injuries and fires. Clean-up will be conducted on a daily basis.

CONTRACTOR GENERAL SAFETY REQUIREMENTS

6. Tools or work materials must not be left in close proximity to tracks.
7. Throwing waste, garbage, bottles, refuse, or other such materials on railroad property or disposing of such at other than designated locations is prohibited. Each Contractor, or outside entity, will provide refuse containers at the work site and empty them on a daily basis.
8. Objects which constitute a slipping or tripping hazard must not be left in walking areas.
9. Open fires or fires in barrels are not allowed on railroad property unless appropriate permits are acquired.
10. In all cases, established route of travel in and about the property must be used.
11. Railroad vehicles have an unquestioned right-of-way in all circumstances relating to work on or about the track area.
12. Workers must not wear or use anything which impairs vision or hearing. Listening to personal radios or tape players is prohibited while on duty.
13. All contractor employees working on the Company's property will be required to wear OSHA approved safety glasses with permanently attached side shields, hard hats and above-the-ankle, lace-up, hard toed safety boots with a defined heel and high visibility retro-reflective orange vests. During inclement weather, proper clothing to protect against frostbite, etc., will be worn. Particular attention to footing and the use of proper footwear is essential. Hearing protection, fall protection and respirators will be worn as required by State and Federal regulations. Office employees restricted to office work will not be required to comply.
14. All workers will become familiar with and be capable of recognizing railroad equipment adjacent to the tracks.
15. Walking, stepping or standing on rails or ties, or sitting on any part of track structure except in performance of duty is prohibited. NOTE: The term "track structure" means the space between the rails and within eight feet outside the rails, unless otherwise specified.
16. Workers are prohibited from tampering with switches or any other railroad equipment unless it is necessary for work operation and only in the presence of an authorized railroad worker.
17. Workers must not go underneath rail cars. They must not occupy rail cars except in performance of their duty.

CONTRACTOR GENERAL SAFETY REQUIREMENTS

18. Workers must not cross tracks by crossing over or between cars that are coupled together.
19. Workers must not attempt to catch onto or ride any moving railroad equipment, even though it may be moving slowly.
20. Workers must not take refuge from rain, heat, etc., under or in cars or other rail equipment.
21. Workers are warned that trains, locomotives or cars may be expected at any time, on any track, in either direction, and that they must watch for and keep clear of such movements. Workers must take extra precaution to be on the lookout for approaching trains, especially when working in multiple track territory, when field of vision is limited, or when noisy equipment is in use. A portable air horn may be used by a designated person to warn workers of approaching trains or equipment. Under certain conditions, trains and equipment can approach without being heard. Proper attention and protection are essential to personal safety when working near railroad tracks.
22. Workers shall not work on the track, between tracks in multiple track territory, or nearer than 25 feet to the track without proper flag protection provided by the railroad, unless the track is protected by track bulletin and work has been authorized by the railroad.
23. Any work within 25 feet of the rail, without consideration to height, must be stopped in the clear to acknowledge approaching and passing trains.
24. Work in tunnels, on bridges and overpasses must be done in accordance with a safety plan agreed upon by the Chief Engineer or his representative prior to beginning work in these areas. When work is being done in tunnels, specific requirements must be met and work done under the railroad's supervision.
25. Do not wave arms or objects violently except in an emergency; this is a STOP signal.
26. Workers must not make any movement toward an approaching train or operate machinery in a manner that would cause the engineer to believe that the track is going to be fouled.
27. Crossing tracks immediately in front of moving equipment is prohibited.
28. When necessary to cross any track, look both ways and keep at least 25 feet from the nearest end of stationary rail cars.
29. Machines may be operated across tracks only at established grade crossings. If it is necessary to do so at any other location, it may be done only with permission of and under the supervision of the Chief Engineer or his representative on site.

CONTRACTOR GENERAL SAFETY REQUIREMENTS

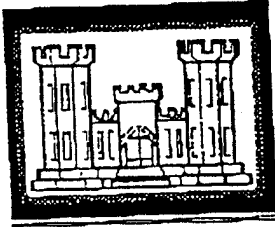
30. Some rails are conductors of electrical current and are integral parts of the railroad's operating system. Devices that could shunt this electrical current must not be laid across rails. No hand or portable tools will be left on the rails at any time. Use a wooden lath to provide separation when making measurements adjacent to the tracks.
31. Machines or vehicles must not be left unattended with the engine running. If a machine is left unattended, it must be in gear with brakes set. If it is equipped with blade, pan or bucket, that must be lowered to the ground.
32. All machinery and equipment left unattended on the right-of-way must be left inoperable and secured against movement.
33. When leaving work site areas at night and over weekends, the areas must be left in a condition that will ensure that railroad employees who might be working in the area are protected from all hazards. Any open pits or holes shall be covered securely and a physical barrier such as a fence placed around the opening.
34. Machinery or equipment shall not be stored or left temporarily near a highway grade crossing in such a manner as to interfere with the sight distances of persons approaching that crossing. Prior to beginning work, the Contractor, or other outside entity, with concurrence of the Chief Engineer or his representative on site, will establish a storage area.
35. Cutting or knocking down trees or moving rocks and other materials that might fall on the track structure or on communications or power lines is prohibited, unless done with the approval and supervision of the Chief Engineer or his representative.
36. Workers must not create and leave any condition at the work site that would interfere with water drainage.
37. Safeguards and safety signs must be kept in place and in good condition. It is the responsibility of the Contractor, or other outside entity, to provide same.
38. Each person in charge of a work party must be familiar with the Mile Post location of the area in which work is being performed so that in cases of emergencies the exact location may be given to railroad personnel.
39. In cases of emergency, it may be necessary for the Contractor's employees or agents to flag and stop approaching trains. Flagging equipment should consist of red fuseses and/or red flags.

CONTRACTOR GENERAL SAFETY REQUIREMENTS

40. When emergency flagging is necessary, Workers should protect against trains moving in both directions.
41. If required to perform emergency flagging, Workers must understand that a great distance is required in which to stop a moving train. The railroad flagger must be at least 1.5 miles from the point being protected in order to provide minimum distance for the locomotive engineer to stop the train. A stop signal is given by swinging the lighted fusee or red flag at right angle to the track, but the engineer will recognize the stop signal if given violently in any manner from a point near the track. Workers, when giving a stop signal, must not stand on or within fouling distance of the track, as normally the engineer will not have the required stopping distance to stop short of the point where the signal is being given.
42. When an emergency exists or if any hazard is noticed on passing trains, the Engineer or his representative on site must be notified immediately.
43. High frequency radios (not CBs) shall be used by all crews for emergency communications between crews.
44. Radio transmitters must not be operated when located less than 250 feet from blasting operations.
45. When it is necessary to create a hazardous condition in performing work on or in the vicinity of a track, proper protection must be afforded in accordance with a safety plan submitted to and approved by the Chief Engineer or his representative prior to creating the hazardous condition, as well as taking any other precautions that may be necessary to protect the condition.
46. Before excavating, it must be ascertained by the Contractor, or other outside entity, if there are underground electric wires, cables, or pipe lines in the vicinity. Excavating on the right of way could result in damage to buried cables resulting in delay to railroad traffic. Before any excavation commences, contact the Northwestern Pacific signal and track representative in charge of the area. All underground and overhead wires are to be considered HIGH VOLTAGE and dangerous until verified with the company having ownership of the line. It is the Contractor's responsibility to notify any other companies that have underground utilities in the area before excavating.
47. If obstructions are encountered that do not appear on drawings, the Chief Engineer must be notified immediately before continuing excavation in the area. If the obstruction is a utility, and the owner of the utility can be identified, then the owner should also be notified immediately. If there is any doubt about the location of underground cables or lines of any kind, no work will be performed until the exact location has been determined. **There will be no exceptions to these instructions.**

CONTRACTOR GENERAL SAFETY REQUIREMENTS

48. All excavations regardless of depth will be shored where there is any danger to track structure or personnel.
49. No excavation will be left uncovered or unprotected overnight.
50. Holes or trenches in the vicinity of the track must be covered, guarded and protected when not being worked on.
51. Excavations, trenches or pits on or adjacent to public roads will be physically protected and denoted by highway barriers with flashing lights when not in use.
52. All excavations will be backfilled as soon as possible.
53. All power line wires must be considered dangerous and of high voltage unless informed to the contrary by proper authority. For lines rated 50KV or below, minimum clearance between the lines and any part of the equipment or load shall be 10 feet. For lines rated over 50KV, minimum clearance between the line and any part of equipment or load shall be 10 feet plus 0.4 inches for each 1KV over 50KV. If the capacity of the line is not known, minimum clearance of 20 feet must be maintained. A person shall be designated to observe clearance of the equipment and give a timely warning for all operations where it is difficult for an operator to maintain the desired clearance by visual means.
54. All work over or within water will meet State and Federal regulations.
55. When Contractor, or other outside entity, employees are required to work on railroad property after normal working hours or on weekends, the railroad representative in charge of the project must be notified. **No one will be allowed to work alone** during the times specified above. When it is necessary to work during these times, a minimum of two employees are required to be present. This could be a railroad employee with a Contractor employee or two Contractor employees.
56. Equipment and vehicles must operate at a safe speed, being aware of operating conditions as well as other equipment and persons working in close proximity. Extreme caution must be exercised at all grade crossings.
57. **IN ALL CASES OF UNCERTAINTY, THE SAFEST COURSE MUST BE TAKEN!**
58. Contractor General Safety Requirement: **IMPORTANT:** Disregard of any of these safety requirements may result in Contractor, or other outside entity, being shut down for a minimum of 48 hours on railroad right-of-way while infraction is investigated. Based on findings of the investigation, it will be determined if the Contractor, or other outside entity, will be allowed to work on Northwestern Pacific right-of-way in the future.



NATIONWIDE PERMIT 15 AND CONDITIONS

U.S. COAST GUARD APPROVED BRIDGES

Discharges of dredged or fill material incidental to the construction of bridges across navigable waters of the United States, including cofferdams, abutments, foundation seals, piers, and temporary construction and access fills provided such discharges have been authorized by the U.S. Coast Guard as part of the bridge permit. Causeways and approach fills are not included in this NWP and will require an individual or regional Section 404 permit. (Section 404)

NATIONWIDE PERMIT CONDITIONS

GENERAL CONDITIONS:

The following general conditions must be followed in order for any authorization by a NWP to be valid:

- 1 Navigation.** No activity may cause more than a minimal adverse effect on navigation.
- 2 Proper maintenance.** Any structure or fill authorized shall be properly maintained, including maintenance to ensure public safety.
- 3 Erosion and siltation controls.** Appropriate erosion and siltation controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date.
- 4 Aquatic life movements.** No activity may substantially disrupt the movement of those species of aquatic life indigenous to the waterbody, including those species which normally migrate through the area, unless the activity's primary purpose is to impound water.
- 5 Equipment.** Heavy equipment working in wetlands must be placed on mats, or other measures must be taken to minimize soil disturbance.
- 6 Regional and case-by-case conditions.** The activity must comply with any regional conditions which may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state or tribe in its section 401 water quality certification.
- 7 Wild and Scenic Rivers.** No activity may occur in a component of the National Wild and Scenic River System; or in a river officially designated by Congress as a "study river" for possible inclusion in

the system, while the river is in an official study status; unless the appropriate Federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely effect the Wild and Scenic River designation, or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency in the area (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service.)

8 Tribal rights. No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

9 Water quality certification. In certain states, an individual Section 401 water quality certification must be obtained or waived (see 33 CFR 330.4(c)).

10 Coastal zone management. In certain states, an individual state coastal zone management consistency concurrence must be obtained or waived (see Section 330.4(d)).

11 Endangered Species. No activity is authorized under any NWP which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act, or which is likely to destroy or adversely modify the critical habitat of such species. Non-federal permittees shall notify the District Engineer if any listed species or critical habitat might be affected or is in the vicinity of the project, and shall not begin work on the activity until notified by the District Engineer that the requirements of the Endangered Species Act have been satisfied and that the activity is authorized. Authorization of an activity by a nationwide permit does not authorize the take of a threatened or endangered species as defined under the Federal Endangered Species Act. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with incidental take provisions, etc.) from the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, both lethal and non-lethal takes of protected species are in violation of the Endangered Species Act. Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the U.S. Fish and Wildlife Service and National Marine Fisheries Service or their world wide web pages at <http://www.fws.gov/~r9endspp/endspp.html> and http://kingfish.spp.mnfs.gov/tmcintyr/prot_res.html#ES and Recovery, respectively.

12 Historic properties. No activity which may affect historic properties listed, or eligible for listing, in the National Register of Historic Places is authorized, until the DE has complied with the provisions of 33 CFR Part 325, Appendix C. The prospective permittee must notify the District Engineer if the authorized activity may affect any historic properties listed, determined to be eligible, or which the prospective permittee has reason to believe may be eligible for listing on the National Register of Historic Places, and shall not begin the activity until notified by the District Engineer that the requirements of the National Historic Preservation Act have been satisfied and that the activity is authorized. Information on the location and existence of historic resources can be obtained from the State Historic Preservation Office and the National Register of Historic Places (see 33 CFR 330.4(g)).

13 Notification.

a) Timing: Where required by the terms of the NWP, the prospective permittee must notify the District Engineer with a Pre-Construction Notification (PCN) as early as possible and shall not begin the activity: 1. Until notified by the District Engineer that the activity may proceed under the NWP with any special conditions imposed by the District or Division Engineer; or 2. If notified by the

District or Division Engineer that an individual permit is required; or 3. Unless 30 days (or 45 days for NWP 26 only) have passed from the District Engineer's receipt of the notification and the prospective permittee has not received notice from the District or Division Engineer. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

b) Contents of Notification: The notification must be in writing and include the following information:

1. Name, address and telephone numbers of the prospective permittee;
2. Location of the proposed project
3. Brief description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause; any other NWP(s), regional general permit(s) or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity; and
4. For NWPs 14, 18, 21, 26, 29, 34, and 38, the PCN must also include a delineation of affected special aquatic sites, including wetlands (see paragraph 13(f));
5. For NWP 21 - Surface Coal Mining Activities, the PCN must include an OSM or state approved mitigation plan.
6. For NWP 29-Single-Family Housing, the PCN must also include:
 - (i) Any past use of this NWP by the individual permittee and/or the permittee's spouse;
 - (ii) A statement that the single-family housing activity is for a personal residence of the permittee;
 - (iii) A description of the entire parcel, including its size, and a delineation of wetlands. For the purpose of this NWP, parcels of land measuring 0.5 acre or less will not require a formal on-site delineation. However, the applicant shall provide an indication of where the wetlands are and the amount of wetlands that exists on the property. For parcels greater than 0.5 acre in size, a formal wetland delineation must be prepared in accordance with the current method required by the Corps. (See paragraph 13(f));
 - (iv) A written description of all land (including, if available, legal descriptions) owned by the prospective permittee and/or the prospective permittee's spouse, within a one mile radius of the parcel, in any form of ownership (including any land owned as a partner, corporation, joint tenant, co-tenant, or as a tenant-by-the-entirety) and any land on which a purchase and sale agreement or other contract for sale or purchase has been executed;
7. For NWP 31- Maintenance of Existing Flood Control Projects, the prospective permittee must either notify the District Engineer with a Pre-Construction Notification (PCN) prior to each maintenance activity or submit a five year (or less) maintenance plan. In addition, the PCN must include all of the following:

Sufficient baseline information so as to identify the approved channel depths and configurations and existing facilities. Minor deviations are authorized, provided that the approved flood control

protection or drainage is not increased;

A delineation of any affected special aquatic sites, including wetlands; and,

Location of the dredged material disposal site.

8. For NWP 33 - Temporary Construction, Access, and Dewatering, the PCN must also include a restoration plan of reasonable measures to avoid and minimize adverse effects to aquatic resources.

c) *Form of Notification:* The standard individual permit application form (Form ENG 4345) may be used as the notification but must clearly indicate that it is a PCN and must include all of the information required in (b) (1)-(8) of General Condition 13. A letter may also be used.

d) *District Engineer's Decision:* In reviewing the pre-construction notification for the proposed activity, the District Engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. The prospective permittee may, optionally, submit a proposed mitigation plan with the pre-construction notification to expedite the process and the District Engineer will consider any optional mitigation the applicant has included in the proposal in determining whether the net adverse environmental effects of the proposed work are minimal. If the District Engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse effects are minimal, the District Engineer will notify the permittee and include any conditions the DE deems necessary.

Any mitigation proposal must be approved by the District Engineer prior to commencing work. If the prospective permittee elects to submit a mitigation plan, the District Engineer will expeditiously review the proposed mitigation plan, but will not commence a second 30-day (or 45-day for NWP 26) notification procedure. If the net adverse effects of the project (with the mitigation proposal) are determined by the District Engineer to be minimal, the District Engineer will provide a timely written response to the applicant stating that the project can proceed under the terms and conditions of the nationwide permit. If the District Engineer determines that the adverse effects of the proposed work are more than minimal, then he will notify the applicant either:

(1) that the project does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit;

(2) that the project is authorized under the NWP subject to the applicant's submitting a mitigation proposal that would reduce the adverse effects to the minimal level; or

(3) that the project is authorized under the NWP with specific modifications or conditions.

e) *Agency Coordination:* The District Engineer will consider any comments from Federal and State agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the project's adverse environmental effects to a minimal level.

(i). For NWP 14, 21, 26 (between 1 and 3 acres of impact), 29, 33, 37, and 38. The District Engineer will, upon receipt of a notification, provide immediately, e.g., facsimile transmission, overnight mail or other expeditious manner, a copy to the appropriate offices of the Fish and Wildlife Service, State natural resource or water quality agency, EPA, State Historic Preservation Officer (SHPO), and, if appropriate, the National Marine Fisheries Service. With the exception of NWP 37, these agencies will

then have 5 calendar days from the date the material is transmitted to telephone or fax the District Engineer notice that they intend to provide substantive, site-specific comments. If so contacted by an agency, the District Engineer will wait an additional 10 calendar days (16 calendar days for NWP 26 PCNs) before making a decision on the notification. The District Engineer will fully consider agency comments received within the specified time frame, but will provide no response to the resource agency. The District Engineer will indicate in the administrative record associated with each notification that the resource agencies concerns were considered. Applicants are encouraged to provide the Corps multiple copies of notifications to expedite agency notification.

(ii) Optional Agency Coordination. For NWPs 5, 7, 12, 13, 17, 18, 27, 31, and 34, where a Regional Administrator of EPA, a Regional Director of USFWS, or a Regional Director of NMFS has formally requested general notification from the District Engineer for the activities covered by any of these NWPs, the Corps will provide the requesting agency with notification on the particular NWPs. However, where the agencies have a record of not generally submitting substantive comments on activities covered by any of these NWPs, the Corps district may discontinue providing notification to those regional agency offices. The District Engineer will coordinate with the resources agencies to identify which activities involving a PCN that the agencies will provide substantive comments to the Corps. The District Engineer may also request comments from the agencies on a case by case basis when the District Engineer determines that such comments would assist the Corps in reaching a decision whether effects are more than minimal either individually or cumulatively.

(iii) Optional Agency Coordination, 401 Denial. For NWP 26 only, where the state has denied its 401 water quality certification for activities with less than 1 acre of wetland impact, the EPA regional administrator may request agency coordination of PCNs between 1/3 and 1 acre. The request may only include acreage limitations within the 1/3 to 1 acre range for which the state has denied water quality certification. In cases where the EPA has requested coordination of projects as described here, the Corps will forward the PCN to EPA only. The PCN will then be forwarded to the Fish and Wildlife Service and the National Marine Fisheries Service by EPA under agreements among those agencies. Any agency receiving the PCN will be bound by the EPA time frames for providing comments to the Corps.

f) Wetlands Delineations: Wetland delineations must be prepared in accordance with the current method required by the Corps. For NWP 29 see paragraph (b)(6)(iii) for parcels less than 0.5 acres in size. The permittee may ask the Corps to delineate the special aquatic site. There may be some delay if the Corps does the delineation. Furthermore, the 30-day period (45 days for NWP 26) will not start until the wetland delineation has been completed and submitted to the Corps, where appropriate. g) Mitigation: Factors that the District Engineer will consider when determining the acceptability of appropriate and practicable mitigation include, but are not limited to:

(i) To be practicable, the mitigation must be available and capable of being done considering costs, existing technology, and logistics in light of the overall project purposes;

(ii) To the extent appropriate, permittees should consider mitigation banking and other forms of mitigation including contributions to wetland trust funds, in lieu fees to organizations such as The Nature Conservancy, state or county natural resource management agencies, where such fees contribute to the restoration, creation, replacement, enhancement, or preservation of wetlands. Furthermore, examples of mitigation that may be appropriate and practicable include but are not limited to: reducing the size of the project; establishing wetland or upland buffer zones to protect aquatic resource values; and replacing the loss of aquatic resource values by creating, restoring, and

enhancing similar functions and values. In addition, mitigation must address wetland impacts, such as functions and values, and cannot be simply used to offset the acreage of wetland losses that would occur in order to meet the acreage limits of some of the NWP (e.g., for NWP 26, 5 acres of wetlands cannot be created to change a 6-acre loss of wetlands to a 1 acre loss; however, 2 created acres can be used to reduce the impacts of a 3-acre loss.).

14 Compliance certification. Every permittee who has received a Nationwide permit verification from the Corps will submit a signed certification regarding the completed work and any required mitigation. The certification will be forwarded by the Corps with the authorization letter and will include:

- a.) A statement that the authorized work was done in accordance with the Corps authorization, including any general or specific conditions;
- b.) A statement that any required mitigation was completed in accordance with the permit conditions;
- c.) The signature of the permittee certifying the completion of the work and mitigation.

15 Multiple use of Nationwide permits. In any case where any NWP number 12 through 40 is combined with any other NWP number 12 through 40, as part of a single and complete project, the permittee must notify the District Engineer in accordance with paragraphs a, b, and c on the Notification General Condition number 13. Any NWP number 1 through 11 may be combined with any other NWP without notification to the Corps, unless notification is otherwise required by the terms of the NWPs. As provided at 33 CFR 330.6(c) two or more different NWPs can be combined to authorize a single and complete project. However, the same NWP cannot be used more than once for a single and complete project.

SECTION 404 ONLY CONDITIONS:

In addition to the General Conditions, the following conditions apply only to activities that involve the discharge of dredged or fill material into waters of the U.S., and must be followed in order for authorization by the NWPs to be valid:

- 1. Water supply intakes.** No discharge of dredged or fill material may occur in the proximity of a public water supply intake except where the discharge is for repair of the public water supply intake structures or adjacent bank stabilization.
- 2. Shellfish production.** No discharge of dredged or fill material may occur in areas of concentrated shellfish production, unless the discharge is directly related to a shellfish harvesting activity authorized by NWP 4.
- 3. Suitable material.** No discharge of dredged or fill material may consist of unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.) and material discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).
- 4. Mitigation.** Discharges of dredged or fill material into waters of the United States must be minimized or avoided to the maximum extent practicable at the project site (i.e., on-site), unless the District Engineer approves a compensation plan that the District Engineer determines is more beneficial to the environment than on-site minimization or avoidance measures.

5. Spawning areas. Discharges in spawning areas during spawning seasons must be avoided to the maximum extent practicable.

6. Obstruction of high flows. To the maximum extent practicable, discharges must not permanently restrict or impede the passage of normal or expected high flows or cause the relocation of the water (unless the primary purpose of the fill is to impound waters).

7. Adverse effects from impoundments. If the discharge creates an impoundment of water, adverse effects on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow shall be minimized to the maximum extent practicable.

8. Waterfowl breeding areas. Discharges into breeding areas for migratory waterfowl must be avoided to the maximum extent practicable.

9. Removal of temporary fills. Any temporary fills must be removed in their entirety and the affected areas returned to their pre-existing elevation.

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[Nationwide Permits](#)

165 North Redwood Drive

Suite 120

San Rafael, California 94903

F 415 / 491-1831

T 415 / 491-1338

GEOTECHNICAL INVESTIGATION
NORTHWESTERN PACIFIC RAILROAD
MAINLINE BRIDGE REPLACEMENT
PETALUMA, CALIFORNIA

March 4, 1999

Project 243.19

Prepared For:
City of Petaluma
P.O. Box 61
Petaluma, California 94953-0061

CERTIFICATION

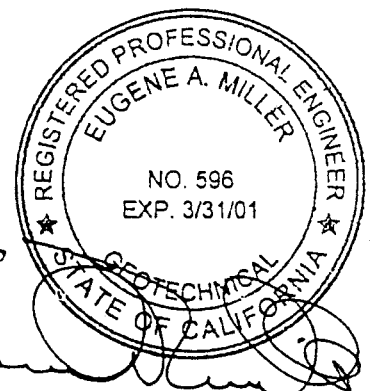
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MILLER PACIFIC ENGINEERING GROUP
(a California corporation)

REVIEWED BY



Scott A. Stephens
Geotechnical Engineer No. 2398
(Expires 6/30/01)



Eugene A. Miller
Geotechnical Engineer No. 596
(Expires 3/31/01)

GEOTECHNICAL INVESTIGATION
NORTHWESTERN PACIFIC RAILROAD
MAINLINE BRIDGE REPLACEMENT
PETALUMA, CALIFORNIA

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GEOTECHNICAL INVESTIGATION
NORTHWESTERN PACIFIC RAILROAD
MAINLINE BRIDGE REPLACEMENT
PETALUMA, CALIFORNIA

I. INTRODUCTION

This document presents the results of our geotechnical investigation for the planned replacement of the Northwestern Pacific Railroad's Mainline Bridge in Petaluma, California. The purpose of our geotechnical investigation is to evaluate site conditions and provide geotechnical recommendations for the design and construction of the project. This report is intended for use by the City of Petaluma, Winzler & Kelly Consulting Engineers, and the project design team.

The scope of our geotechnical services was described in our proposal dated January 25, 1999. Our geotechnical investigation includes a review of available geologic/geotechnical data, subsurface exploration to supplement Miller Pacific's and the Corp of Engineers' previous exploration, laboratory testing, geotechnical evaluation, geotechnical analyses, and preparation of a written report that summarizes our recommendations and design criteria for the planned bridge.

The following geotechnical considerations are addressed in this report:

- (1) Expected subsurface conditions;
- (2) Evaluation of geologic hazards;
- (3) Foundation design;
- (4) Seismic design criteria;
- (5) Judgement of excavation conditions;
- (6) Site grading;
- (7) Expected settlement of earth embankments and bridge foundations;
- (8) Recommended pavement section.

Investigation for hazardous materials or soil and groundwater contamination is specifically excluded from our scope of work.

II. PROJECT DESCRIPTION

The planned project involves replacing an existing timber railroad bridge as part of the Petaluma River flood control improvements in Petaluma, California. The approximate location of the project site is shown on Figure 1. To increase flow capacity within the river, the new bridge will be higher and longer than the existing bridge with fewer supports in the river.

The City of Petaluma and Corps of Engineers are working jointly to construct the Petaluma River flood control improvements. The City of Petaluma is responsible for the replacement of the Mainline Railroad Bridge. Winzler and Kelly Consulting Engineers is providing the civil and structural design for the new bridge.

Based on our discussions with Winzler and Kelly, the new bridge will be located parallel and roughly twenty feet south of the existing timber bridge. The new railroad bridge will be a two-span, reinforced concrete structure. The center bent and abutments will be supported on piles driven into the dense soils that underlie the project site. The bottom of the pile caps will be at an elevation of -11 or -12. The preliminary design load for the piles is 70 tons. It is our understanding that several of the piles will be battered to increase lateral resistance.

The elevation of the railroad will be raised roughly four feet and the length increased. The new railroad tracks will need to gently slope down and connect with the existing tracks several hundred feet from the bridge. Retaining walls will be required adjacent to Les's Auto & Truck Repair and along Lakeville Street where compacted fill slopes would encroach onto private property. The maximum height of the retaining walls is about four feet.

Since the planned railroad tracks will cross Lakeville Street at an increased elevation, a portion of Lakeville Street near Madison Street will be raised and reconstructed.

III. GEOLOGIC SETTING

A. Regional Geology

Sonoma County is within the Coast Range Geomorphic Province of California. This area is characterized by northwest-southeast trending mountain ridges and intervening valleys that were formed from tectonic activity between the Pacific and North American Plates. Tectonic activity within the Coast Range Geomorphic Province is concentrated along the San Andreas Fault Zone.

The NWP Railroad Bridge is located within the Petaluma alluvial valley. Geologic mapping performed by the California Division of Mines and Geology (CDMG, 1980) indicates that the project site is located near a geologic contact between alluvial deposits (Qyfo) of sand, silt and silty clay and younger bay mud (Qbm). The depth of the alluvial material has also been roughly interpreted by CDMG to be up to 200 feet. The interpretation of the regional geology is based on widely spaced borings and surface observations.

Bedrock at the project site is expected at significant depth below the alluvial soils. The bedrock is most likely fine-grained sandstone and tuff of the Merced Formation. However, depending on the dip of the rock formations, sandstone and shale of the Franciscan Formation or volcanic rocks of the Sonoma Volcanics Formation could also be present.

B. Seismicity

The NWP Railroad Bridge is located within the seismically active San Francisco Bay Region and will therefore experience the effects of future earthquakes. Such earthquakes could occur on any of several active faults within the region. The CDMG (1994) has mapped various active and inactive faults in the region. The active faults in the region, i.e. those that show evidence of movement in the past 11,000 years, are shown on the Active Fault Map, Figure 2.

The United States Geological Survey (USGS) assembled the "Northern California Earthquake Potential Working Group" to evaluate earthquake probability in this region. Sixty-two potential sources were analyzed to develop estimates of the probability (i.e. recurrence intervals) of earthquakes with a Moment Magnitude greater than 6.5 to occur. The slip rates and recurrence intervals for faults in the San Francisco Bay Area are presented in Table A.

TABLE A
 SUMMARY OF EARTHQUAKE RECURRENCE INTERVALS
SAN FRANCISCO BAY AREA

<u>Fault Segment</u>	<u>Largest Historical Event</u>		<u>Observed Slip Rate (mm/year)</u>	<u>Estimated Recurrence Interval (years)</u>	<u>Expected Future Magnitude²</u>
	<u>Year</u>	<u>Magnitude¹</u>			
SAN ANDREAS					
North Coast	1906	8.2	24	210	7.9
Peninsula	1906 ³	7.1	17	400	7.1
Santa Cruz	1989	7.0	14	400	7.0
HAYWARD					
North Segment	1836? ⁴	6.8	9	210	7.5
South Segment	1868	6.8	9	210	6.9
RODGERS CREEK	1898 ⁵	6.5	9	230	7.0
SAN GREGORIO	Unknown ⁶	Unknown ⁶	5	400	7.0
CONCORD	1955	5.4	6	240	6.5
GREEN VALLEY	1892	6.4	6	330	6.7
CALAVERAS					
North Segment	1861	6.5	6	400	7.0
South Segment	1984 ⁵	5.9	15	60	6.2
MAACAMA	Unknown ⁶	Unknown ⁶	9	220	6.9

Notes:

- (1) Richter Magnitude
- (2) Moment Magnitude
- (3) A Magnitude 7.0 may have occurred on this segment in 1838. The 1906 event broke the entire length of this segment, but measured strains were substantially less than the North Coast portion suggesting this segment is independent of the North Coast and Santa Cruz segments.
- (4) Recent studies suggest this event did not occur on the Hayward Fault.
- (5) These large events are not considered strong enough to have relieved current strain accumulation on the particular fault.
- (6) No confirmed recorded large events in historical accounts (generally last 150 to 200 years).

References: USGS (1996) and Topozada and Borchardt (1998)

The probability of an event increases as the interval from the previous large event approaches and surpasses the recurrence interval. The probability will continue to increase until a seismic event occurs on a fault or fault segment releasing the accumulated strain. Recent USGS studies identified four fault segments in the Bay Area that are most likely to produce a large earthquake. These fault segments are:

- The San Andreas Fault (Peninsula Segment) between Los Gatos and Hillsborough;
- The Hayward Fault (South Segment) between Fremont and San Leandro;
- The Hayward Fault (North Segment) between San Leandro and San Pablo Bay; and
- The Rodgers Creek Fault between San Pablo Bay and Santa Rosa.

The USGS concluded that major earthquakes (magnitude 7 or larger) are likely on each of these four fault segments within the next 100 to 150 years and each has an estimated 20 to 30 percent probability of occurrence in the next 30 years. When the probabilities are combined mathematically, there is a 67 percent chance for a magnitude 7 or larger earthquake to occur in the Bay Area over the next 30 years.

Additional studies by the USGS regarding the probability of large earthquakes are on going. These current evaluations include data from additional active faults and updated geological data.

III. SITE CONDITIONS

A. Site Reconnaissance

We performed a site reconnaissance with Winzler & Kelly on January 21, 1999 to observe site conditions and to define a field exploration program. West of the Petaluma River, the new railroad bridge and track will be relocated within a strip of level land between Les's Truck & Auto Repair and the existing railroad track.

On the east side of the Petaluma River, the new railroad alignment crosses Lakeville Street and merges with the existing railroad tracks on the south side of Lakeville Street. The site conditions consist of relatively level grade with several utilities within and adjacent to Lakeville Street.

To reasonably estimate subsurface conditions at the bridge site, four exploratory borings were located to supplement previous exploration. Underground Service Alert (USA) was notified to identify nearby underground utilities. The site reconnaissance did not identify any unusual topographic or geologic features.

B. Field Exploration and Laboratory Testing

Subsurface conditions were explored by drilling four new exploratory borings at the locations shown on Figure 3. The borings were drilled with a truck-mounted drill rig using 6-inch solid augers. The depth of the borings range from 10.5 to 41 feet below the ground surface. The soils encountered were logged in the field in accordance with the soil classification chart presented on Figure A-1. The new boring logs are presented on Figures A-2 through A-6. The subsurface exploration program is discussed in detail in Appendix A.

Reference data from previous investigations near the project site was also utilized in our evaluation and analyses. The location of previous subsurface exploration is also shown on Figure 3. Copies of the boring logs and plots of Cone Penetration Test (CPT) data are presented on Figures A-7 to A-19. Interpreted strength parameters from the CPT data are presented on Figure A-20.

Soil samples collected during the subsurface exploration were tested in our laboratory to evaluate the engineering characteristic of the soils. Laboratory testing on select samples consisted of moisture content, dry density, unconfined shear strength, consolidation and grain size. The results of the moisture content, dry density and unconfined shear strength are presented on the boring logs. A plot of the consolidation test is presented on Figure A-21. Sieve analyses were performed to aid in classifying soil samples. The results of the sieve analyses are shown on Figure A-22. We also reviewed the results of laboratory testing from previous investigations. The laboratory testing program is discussed in more detail in Appendix A.

C. Local Geologic Conditions

The subsurface conditions encountered during our exploration differ from the interpreted regional geologic conditions. Soft bay mud was not encountered as indicated from the regional geologic maps. The actual local geologic conditions consist of interbedded layers of alluvial sand, silt and clay.

The geologic conditions are consistent with flood-plain materials that are deposited as ancient rivers meandered across the Petaluma Valley. Due to the variable nature of the alluvial soils, the delineation of the subsurface conditions is based on similar soil type, consistency, and engineering properties. In general, the subsurface conditions consist of roughly twenty eight feet of soft to medium stiff clay and loose to medium dense sand over a thick deposit of dense sand and gravel with occasional stiff clay layers.

Groundwater was encountered during the subsurface exploration between elevation +1.0 and +4.0. The depth to groundwater was measured during drilling and may not represent the stabilized groundwater level. The observed groundwater levels in the borings near the Petaluma River roughly correlate with the water level in the river. Borings further from the river appear to have a more stable groundwater level near elevation +1.0.

V. GEOLOGIC HAZARDS

A. General

A brief discussion of various geologic hazards and warranted mitigation options are presented below. The significant geologic hazards that may affect the project site include ground shaking, liquefaction, lurching, and erosion.

B. Fault Surface Rupture

Under the Alquist-Priolo Special Studies Zone Act, the California Division of Mines and Geology (CDMG) produced 1:2000 scale maps showing all active faults. The planned NWP Railroad Bridge is not located within an Alquist-Priolo Special Studies Zone and is not near any of the known active faults. Considering the absence of recognized active faults and the significant depth of the alluvial soils, the potential for surface fault rupture at the site is remote.

No mitigation measures are required.

C. Seismic Ground Shaking

The site will experience ground shaking similar to other areas in the seismically active San Francisco Bay Region. The intensity of earthquake motion at the site will depend on the characteristics of the generating fault, distance to the earthquake epicenter, the magnitude and duration of the earthquake and site specific geologic conditions.

The expected ground accelerations at the site from earthquakes on various active faults are shown in Table B. These accelerations are for an earthquake originating on the closest portion of the fault to the site.

TABLE B
 ESTIMATED GROUND MOTION CHARACTERISTICS
 NWPRR BRIDGE, PETALUMA, CALIFORNIA

Fault/Segment	Expected Future Event				
	Magnitude ¹	Duration (sec)	Distance ² (km)	Peak Ground ³ Acceleration (g)	Standard Deviation (g)
SAN ANDREAS					
North Coast	7.9	37	23	0.28	0.15
Peninsula	7.1	29	56	0.08	0.04
HAYWARD	7.5	26	32	0.18	0.09
North Segment	6.9	18	32	0.14	0.07
South Segment	6.9	27	80	0.05	0.03
RODGERS CREEK	7.0	16	8	0.37	0.21
SAN GREGORIO	7.0	21	49	0.09	0.05
CONCORD	6.5	15	53	0.05	0.04
GREEN VALLEY	6.7	21	40	0.10	0.06
CALAVERAS	7.0	24	72	0.07	0.03
MAACAMA	6.9	18	27	0.14	0.08
GREENVILLE	6.8	24	67	0.05	0.03
WEST NAPA	6.5	13	27	0.13	0.08

Notes:

- (1) Moment magnitude
- (2) Site distance to closest fault trace, see Figure 2.
- (3) Median peak acceleration from rock attenuation relationships by Idriss (1995).

Reference: USGS (1996)

The accelerations presented in the previous Corp of Engineers' report are higher than the accelerations presented above. The accelerations determined by the Corp were based on older attenuation curves for a "hard site." The accelerations presented in Table B were developed using attenuation curves that incorporate data from more recent earthquakes. The spectral accelerations at the ground surface should be evaluated using the Caltrans ARS curve for 80-150 feet of alluvium as shown on Figure 4.

Seismic Shaking Mitigation Measures - At a minimum, the Uniform Building Code recommends structures be designed to prevent failure or collapse during a strong earthquake. Mitigation measures include designing the improvements and structures in accordance with the most recent version of Caltrans bridge design criteria or other applicable codes. Typical design level accelerations for most structures are based on the median peak horizontal acceleration. For the railroad site, the design bedrock acceleration is 0.37g.

D. Liquefaction Potential

Liquefaction refers to the sudden, temporary loss of soil strength during ground shaking. This phenomenon can occur where there are saturated, loose, granular deposits. Due to the presence of these types of cohesionless soils at the site, analyses were performed to evaluate the potential for liquefaction.

To evaluate soil liquefaction, the seismic energy from an earthquake is compared with the ability of the soil to resist pore pressure generation. The earthquake energy is termed the cyclic stress ratio (CSR) and is a function of horizontal acceleration and depth. The soil resistance is based on the relative density and percent silt and clay of the soil. The relative density of cohesionless soil is correlated with corrected blow count data $(N_1)_{60}$ measured during exploration and percent fines determined from laboratory testing. The results of our liquefaction evaluation are presented on Figure 5. There is a moderate potential for liquefaction of localized layers of loose sands between elevation +4 and -18.

Liquefaction Mitigation Measures - To mitigate possible loss of foundation support due to soil liquefaction, the bridge foundation must extend below the susceptible soils. A detailed discussion of the recommended bridge foundation is presented in subsequent sections of the report.

Liquefaction can also produce surface manifestation such as sand boils and localized ground settlement. Studies by Ishihara (1985) predict surface manifestation based on the thickness of the non-liquefiable surface layer, the thickness of the liquefiable layer and ground acceleration. For the site conditions, it appears that the potential for surface manifestation is low to moderate. Although significant distress to improvements on the ground surface is not expected, a detailed site reconnaissance should be performed following a strong earthquake to inspect the site for any damage to the railroad tracks or retaining walls.

E. Seismic Induced Ground Settlement

Ground shaking can induce settlement of loose granular soils above the water table. The soils encountered above the groundwater were clay or medium dense sand that are not prone to significant seismic induced settlement. Thus, settlement of the fill during a seismic event would be relatively minor.

No mitigation measures are required.

F. Seismic Lurching and Ground Cracking

Seismic lurching and associated ground cracking can occur during strong ground shaking. The ground cracking generally occurs along the tops of slopes where stiff soils are underlain by soft deposits or along steep channel banks. Since both of these conditions exist at the project site, the potential for seismic lurching and associated ground cracking to occur is moderate.

Lurching and Ground Cracking Mitigation Measures - The bridges and abutments should be structurally designed to resist seismic forces. Seismic design criteria for the abutments are presented in subsequent sections of the report.

Some ground cracking and channel bank sloughing may occur in the unimproved areas adjacent to the Petaluma River. Since no structures are planned in these areas, mitigation measures are not warranted.

G. Erosion

Sandy soils on moderate slopes or clayey soils on steep slopes are susceptible to erosion when exposed to concentrated surface water flow. The potential for erosion is increased when established vegetation is disturbed or removed. Most of the site is relatively level, thus the potential for significant erosion is minimal. However, the riverbanks and bed could experience some erosion or scour.

Erosion Mitigation Measures – To reduce the risk of erosion, avoid concentrating surface water onto the riverbanks. Any erosion features that develop should be repaired by diverting surface water away from the eroding area and backfilling with compacted clayey fill material. In addition, all slopes disturbed by grading should be jute-netted and hydro-seeded to establish natural vegetation on the slopes.

Protection from erosion "scour" of the riverbed has been addressed in the Corp of Engineers' investigation. Rip-rap and stabilization fabric are planned within the channel for protection against erosion.

H. Seiche and Tsunami

Seiche and tsunamis are short duration earthquake-generated water waves in enclosed bodies of water and in the open ocean, respectively. The extent and severity of a seiche would depend on ground motions and fault offset in the Petaluma River or San Pablo Bay. A seiche wave at the NWP Railroad site is expected to be very small.

Ritter and Dupre (1972) show areas of potential inundation for an ocean generated tsunami with a 20-foot (6 m) run up at the Golden Gate. The tsunami wave is attenuated (reduced) as it propagates farther into the bay. At the project site, it is estimated that the maximum run-up from a tsunami with a 100-year return period would be insignificant.

No mitigation measures are required.

I. Flooding

The potential for flooding exists at the project site. The primary goal of the planned improvements is to reduce the flooding potential and minimize damage to the surrounding area. Damage to the new bridge from flooding is expected to be minimal.

Flooding Mitigation Measures - Mitigation measures, if any, should be determined by the project Civil Engineer.

J. Settlement

Soil settlement has two basic forms: elastic and consolidation. Elastic settlements occur from loads that cause deformation and compression of the soils structure. Elastic settlement typically occurs within the first few days or weeks after construction. Consolidation settlement usually takes many years to complete. We did not encounter thick layers of soft compressible clays that would be subject to long term consolidation.

Settlement Mitigation Measures – Some settlement is expected after construction of the planned embankments. To reduce differential settlement between the tracks and the bridge abutments, a temporary surcharge fill is recommended. A more detailed discussion regarding the temporary surcharge is presented in subsequent sections of the report.

K. Expansive Soil

During our site reconnaissance, we did not observe signs that the on-site fill soils are expansive. We judge that the potential for structural damage due to expansive soils is low.

No mitigation measures are required.

IV. DISCUSSION AND RECOMMENDATIONS

A. General

The planned new NWP Railroad Mainline Bridge is feasible from a geotechnical standpoint. The primary geotechnical issue is appropriate foundation and abutment design for the seismic and geologic conditions at the project site. Geotechnical recommendations for the design of the project and mitigation of geotechnical concerns are presented in the following sections.

B. Bridge Foundation Design

New foundations will be required to support the planned railroad bridge. Considering the presence of soft and potentially liquefiable soils, a deep foundation system is recommended. It is our understanding that preliminary design of the bridge utilizes steel H-piles.

We considered various deep foundation systems including drilled piers, concrete piles and steel piles. If drilled piers are used, the presence of high groundwater and caving soils would require continuous casing or drilling fluid to support the excavation. Construction would be difficult and costly. Adequate embedment of pre-stressed reinforced concrete piles into the dense sands would be difficult due to the larger end bearing area. Therefore, we concur with the preliminary design selection of the steel H-piles.

The steel H-pile foundation will obtain support from the non-liquefiable dense sand and gravel underlying the upper soft soils. The H-piles can be driven into the dense sands to provide the required uplift resistance.

1. Vertical Capacity. The vertical capacity of the driven piles depends on the subsurface conditions and the depth of penetration into firm material. The piles capacity include both friction and end bearing, however, the end bearing contribution is small compared to the friction. The allowable pile downward and upward capacity for various sized H-piles is presented on Figure 6. In accordance with the American Railway Engineering Association's recommendations, a factor of safety of 3 has been incorporated into the downward capacity and a factor of safety of 2 incorporated into the uplift capacity.

For a 70-ton pile, the recommended minimum tip elevation is shown on Figure 6. Depending on the pile size selected, the piles will be driven 15 to 30 feet into the dense sands to achieve the design capacities. Due to the variability of alluvial soil deposits, we recommend the piles be ordered longer than necessary and cut off at the required elevation.

2. Lateral Capacity. The allowable lateral capacity of vertical piles is a function of displacement and takes into account the stiffness of both the soil and pile. The results of our calculation for ultimate lateral capacity for various piles with 50% fixity are shown on Figure 7. The lateral capacities shown are for displacement in the direction of the strong axis of the H-pile. The designer should orient the piles in the direction of the needed lateral capacity. If requested, we can provide lateral capacity for the weak axis of the pile.

The displacement of the top of the vertical piles will also induce moment in the pile. The maximum induced moment as a function of displacement is also presented on Figure 7.

Inclined battered piles are planned to provide increased lateral resistance. It needs to be noted that battered piles will pick up lateral load faster than vertical piles and may over-stress the inclined piles. We recommend either eliminating the inclined piles or providing enough inclined piles to carry the entire lateral load.

3. Pile Spacing. To achieve the individual pile design loads presented above, the piles need to be spaced at least three pile diameters apart. If the spacing is less than three pile diameters, the design loads will need to be reduced to account for group effects.

4. Load Testing. The American Railway Engineering Association states that load testing is essential for large and important jobs or if there is little subsurface information. Considering the extent of subsurface exploration and nearby pile driving experience, we judge that a static pile load test is not warranted, provided that dynamic testing is conducted during construction to verify the pile capacity.

5. Pile Corrosion. The Petaluma River is tidally influenced at the project site. The presence of saline tidal water suggests corrosion needs to be considered in the foundation design. If requested, pH and resistivity tests can be performed on the soils to aid in the corrosion evaluation.

6. Construction Observation. Careful selection of the pile driving equipment and control of blow counts will be necessary to preclude overdriving and pile damage. Double acting or diesel hammers should be used. Drop hammers should not be used. We recommend using a hammer that delivers an energy rating over 35,000 foot-pounds per blow. The required blow count to achieve the design loads will be calculated when the pile driving equipment is known. We will need to observe the pile driving and dynamic testing to confirm that subsurface conditions and pile capacities are as expected and to modify the pile driving operations, if necessary.

C. Retaining Wall Design

Retaining walls are planned along railroad embankment where the embankment would encroach onto private property. Pursuant to discussions with Winzler & Kelly, the maximum height of the required embankment walls is about 5 feet. The planned cantilever embankment walls, which are free to deflect at the top, shall be designed using the criteria for embankment walls shown in Table C.

The abutments will be restrained by the bridge structure with minimal allowable deflection at the top of the wall. Restrained conditions are commonly designed using an apparent earth pressure design with a uniform pressure distribution rather than an equivalent fluid pressure. The abutments shall be designed with the values shown in Table C.

Considering the proximity of the Rodgers Creek fault, the retaining wall design should include a seismic surcharge load. Since seismic loading is a short-term condition, the design factor of safety including the seismic surcharge can be reduced to 1.0.

The retaining wall's design must include a surcharge from train loads on the railroad. The estimated surcharge load is based on a Cooper E 80 loading with a maximum axle load of 80 kips or an average loading of 10 kips per linear foot. The surcharge load for the embankment wall is based on the center of the railroad, ten feet from the retaining wall, and at the top of a 2:1 slope 5 feet high. The surcharge for the abutment assumes an eight-foot railroad tie located 1 foot from the abutment wall.

Of the several types of retaining walls that were considered, reinforced concrete walls appear best suited for the site conditions. Vertical and lateral support for the planned embankment walls can be obtained from a shallow foundation bearing on firm compacted soil. Due to the presence of soft and potentially liquefiable soils at depth, vertical and lateral support for the abutments should be obtained from driven piles. The abutment wall should be structurally separated from the embankment walls.

We have also been asked to comment of the use of the Caltrans 7.7 ksf allowable passive pressure for the abutment walls. In our opinion, the allowable Caltrans passive resistance does not consider the site-specific soil conditions or wall dimensions. We recommend using a 250 pcf (equivalent fluid pressure) passive resistance for design. This design resistance includes a factor of safety of 1.5

TABLE C
RETAINING WALL DESIGN CRITERIA
NWP RAILROAD MAINLINE BRIDGE

Shallow Foundation

Allowable bearing capacity (dead plus live loads) ¹ :	2000 psf
Lateral passive resistance ^{2,3} :	250 pcf
Base friction coefficient:	0.35

Earth Pressure

Abutment Walls ^{4,5}	
Level Ground	30H psf
2:1 Slope	60H psf
Embankment Walls ^{2,5}	
Level Ground	30 pcf
2:1 Slope	50 pcf

Seismic Surcharge ⁶

Abutment Wall	25H psf
Embankment Walls	15H psf

Railroad Surcharge

Abutment Walls (90° to rail)	0 to 2 feet	1000 psf
	2 to 5 feet	250 psf
Embankment Walls (parallel rail)	0 to 5 feet	200 psf

Notes:

- (1) May increase 1/3 for total design loads.
- (2) Equivalent fluid pressure.
- (3) Ignore upper 6 inches for passive resistance .
- (4) Rectangular uniform pressure distribution (H = height of wall).
- (5) Interpolate earth pressures for intermediate slopes.
- (6) Rectangular distribution, resultant force for restrained walls acts at a distance of 0.6H feet above the base. The factor of safety for short-term seismic conditions can be reduced to 1.0 or greater.

All retaining walls shall have wall drainage. Either Caltrans Class 1B permeable material within filter fabric or Caltrans Class 2 permeable material can be used. The permeable material shall extend at least 12 inches (300 mm) from the back of the wall and be continuous from the bottom of the wall to within 12 inches (300 mm) of the ground surface for exterior walls. The upper 12 inches of backfill for exterior walls shall be compacted impermeable soil.

Seepage should be collected in a 4-inch (100-mm) perforated PVC drain line at the base of the wall and conveyed off-site in closed pipe by gravity to the storm drainage system. The pipe shall have a minimum slope to drain of 1 percent. To maintain the wall drainage system, clean outs shall be installed at the upstream end and at all major changes in direction. Alternatively, weep holes can be designed into the retaining walls to dissipate hydrostatic pressure.

D. Settlement

The upper twenty-eight feet of the alluvial soils at the project site are compressible. The preliminary plans indicate that up to four feet of new fill will be required to raise the elevation of the railroad tracks. Anticipated settlement, due to the placement of the new fill, will be about 2 to 3 inches. Most of this settlement is expected to occur within six weeks after construction of the embankment. Settlement of the bridge constructed on a deep foundation system should be negligible.

Due to the potential for differential settlement between the pile-supported bridge and the approach embankment fills, we recommend placement of a temporary surcharge fill prior to construction of the new railroad tracks. The surcharge fill will accelerate the settlement and reduce differential settlement.

Four feet of temporary surcharge fill should be placed on top of the final grade. The temporary fill should extend a distance of thirty feet from the bridge structure and then taper down to final grade in the next thirty feet. The surcharge fill shall be placed on both approaches to the new bridge. The surcharge fill shall remain in-place for a period of at least two months. If feasible, the settlement of the surcharge fill should be monitored.

E. Excavation

Excavation and shoring is required for the construction of the new bridge foundations.

1. Excavation Conditions. The soil conditions encountered during our subsurface exploration can be excavated with conventional equipment (i.e. backhoe or excavator). The saturated, cohesionless sands or gravel are prone to raveling or "running," therefore temporary continuous shoring will be required to support the excavation and reduce the potential for settlement of the adjacent streets, utilities or structures.

In order to maintain dry working conditions, de-watering will likely be required for excavations below a depth of about 10 feet. Considering the high permeability of the subsurface soils and the proximity to the Petaluma River, a significant amount of groundwater infiltration is expected below the water table. It will be advantageous for the Contractor to select a relatively tight shoring system.

2. Excavation Shoring. The Federal Occupational Safety and Health Administration (OSHA) has promulgated rules for Excavations, 29 CFR Part 1926, October 31, 1989. OSHA dictates allowable slope configurations and minimum shoring requirements based on categorized soil types. In conformance with OSHA's categorization, both the fill material and alluvial soils to a depth of about twenty-eight feet are "Type C" soil. The Contractor may elect to use a variety of shoring configurations, but his operations must conform to Federal and State OSHA regulations. Additionally, it should be made clear that the safety of excavations, slopes, construction operations, and personnel are the sole responsibility of the Contractor.

F. Site Grading

Fill placement is required to raise the street and railroad elevation to the planned grade. Where fills are to be placed, the subgrade should be prepared and the fill material properly placed, conditioned and compacted. On-site material from excavations can be used as fill material provided it does not contain organic material. The use of on-site material will likely need to be dried to reduce moisture content to an acceptable level. Any imported fill material needs to be tested to determine its suitability and maximum dry density. Site grading should conform to the following recommendations.

1. Surface Preparation. In non-improved areas, clear all grass, brush, topsoil, over-size debris, and organic material from areas to be graded. Within paved areas, the existing asphalt and base rock may be broken up and left in place, unless prohibited by the City of Petaluma. Scarify and moisture-condition the upper eight inches of the subgrade and compact it to at least 90 percent relative compaction (as determined by ASTM D 1557). All excess and unsuitable material shall be hauled off site and legally disposed.

2. Compacted Fill. For compacted fill, use soil/rock mixtures that are: (1) free of organic material, (2) have a Liquid Limit less than 40 and a Plasticity Index less than 25, and (3) have a maximum particle size of 4 inches. It appears that most of the existing soils at the site meet the criteria for general fill. Structural fill material used within the uppermost 18 inches of the street subgrade shall meet the criteria for fill presented above and have a minimum R-value of 30.

The fill shall be moisture conditioned to near the optimum moisture content, placed in uniform lifts not exceeding 8 inches thick and compacted to 90 percent relative compaction, unless otherwise specified. The relative compaction shall be measured to the maximum dry density of the fill material in accordance with ASTM Test Method D1557, "Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using a 10-lb. Rammer and 18-in. Drop."

3. Trench Bedding and Backfill. A minimum of 6 inches of sand (or other approved pipe bedding material) shall be placed in the bottom of trench excavations. The sand shall be continuous around the utility pipe and extend at least 6 inches above the top of pipe. The sand shall be compacted to 85 percent relative compaction (R.C.). Intermediate backfill above the sand and up to the subgrade elevation may be select on-site material or Caltrans Class 2 Aggregate Base. Within the roadway, the intermediate backfill shall be compacted to at least 90 percent relative compaction with the uppermost 12 inches compacted to 95 percent relative compaction, in accordance with ASTM D-1557. In non-structural areas, the trench backfill should be constructed to at least 85 percent relative compaction.

4. Maximum Slope Inclination. Grading is required to create embankment ramps to meet the new bridge elevation. Permanent cut and fill slopes should not be steeper than 2:1 (horizontal:vertical). If steeper slopes are required, they will need to be specifically designed.

G. Pavement Design

The construction of the new railroad bridge will require the replacement of a large section of Lakeville Street. The design of the replacement pavement section is based on a Traffic Index (TI) and resistance (R-value) of the subgrade material. The City of Petaluma previously required a Traffic Index of 9.5 for design of Lakeville Street.

The resistance value (R-value) of the subgrade material will depend on the source of the fill used. A previous R-value test was conducted on a bulk sample obtained near CPT 4. The result from this sample was an R-value of 45. To account for the variability of fill material, an R-value of 25 is assumed for preliminary design. During construction, R-value tests should be performed to check the R-value of the actual subgrade material and to adjust pavement design if necessary.

We recommend the following preliminary pavement section for use in the design and bidding of the project.

TABLE D
PRELIMINARY PAVEMENT DESIGN
LAKEVILLE STREET RECONSTRUCTION

	<u>Asphalt-Concrete</u>	Caltrans Class 2 Aggregate Base <u>95% Rel. Comp.</u>	Subgrade Material Min. R-Value = 25 <u>95% Rel. Comp.</u>
Lakeville Street	5 inches	17 inches	Uppermost 12 inches
Option:	Caltrans Class 2 Aggregate (AB) in excess of 6 inches may be replaced with Caltrans Class 2 Aggregate Subbase (ASB) at a ratio of 1.0:1.1 (AB:ASB).		

V. PLAN REVIEW AND CONSTRUCTION INSPECTION

We need to review the plans and specifications when they near completion to confirm that the intent of our geotechnical recommendations have been incorporated and to provide supplemental recommendations if needed.

Construction inspection is necessary to verify that excavation and support conditions are as anticipated and to observe and test the installation of the pile foundations. Some modifications to the design may be required to suit the geotechnical conditions encountered during construction. During grading we shall perform compaction tests and field density tests to confirm backfill material quality and compaction.

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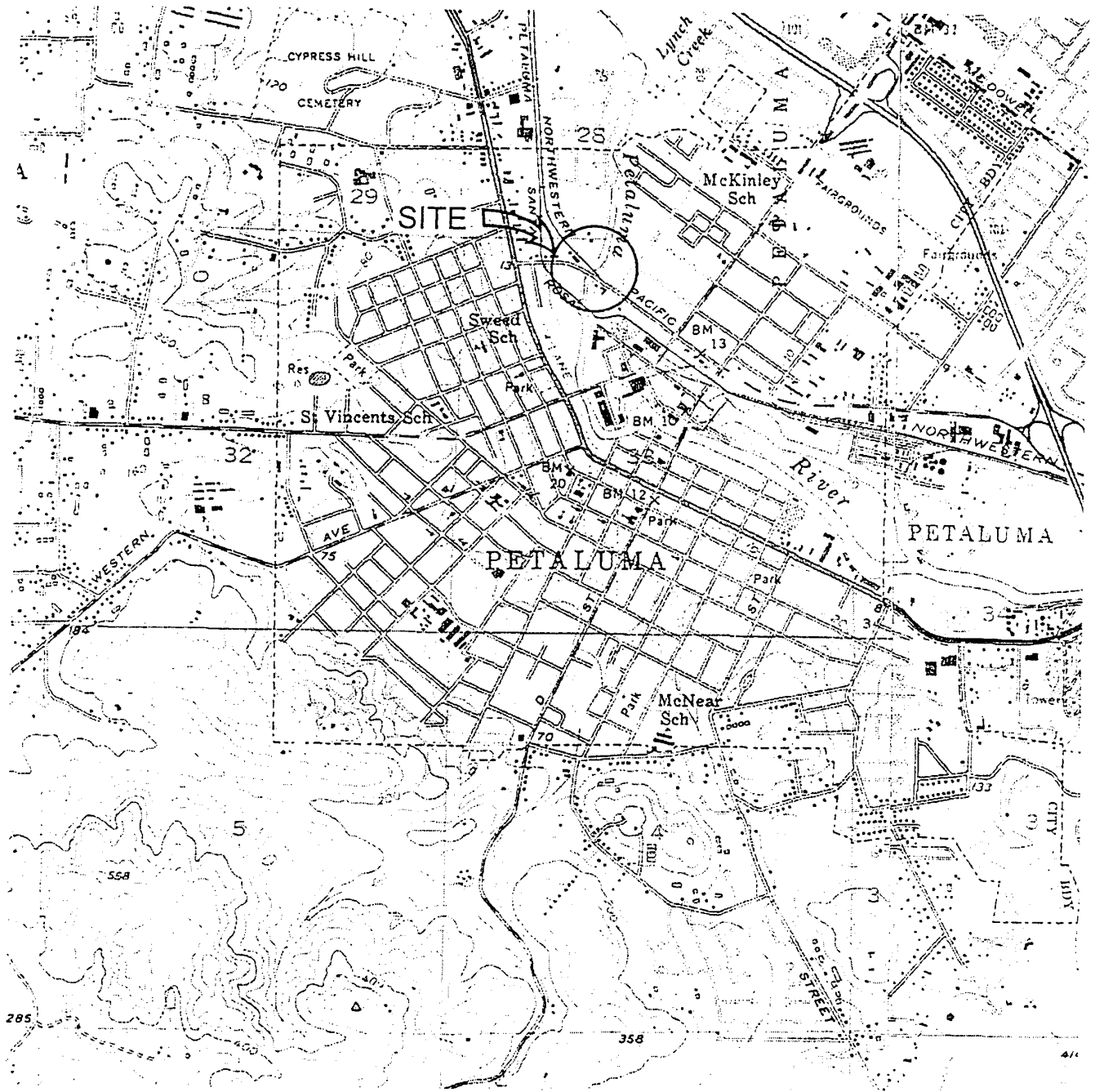
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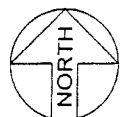
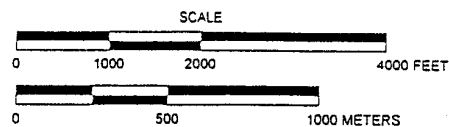
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SITE LOCATION MAP



REFERENCE: USGS, Petaluma Quadrangle

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SITE LOCATION MAP
NWP Railroad Mainline Bridge
Petaluma, California

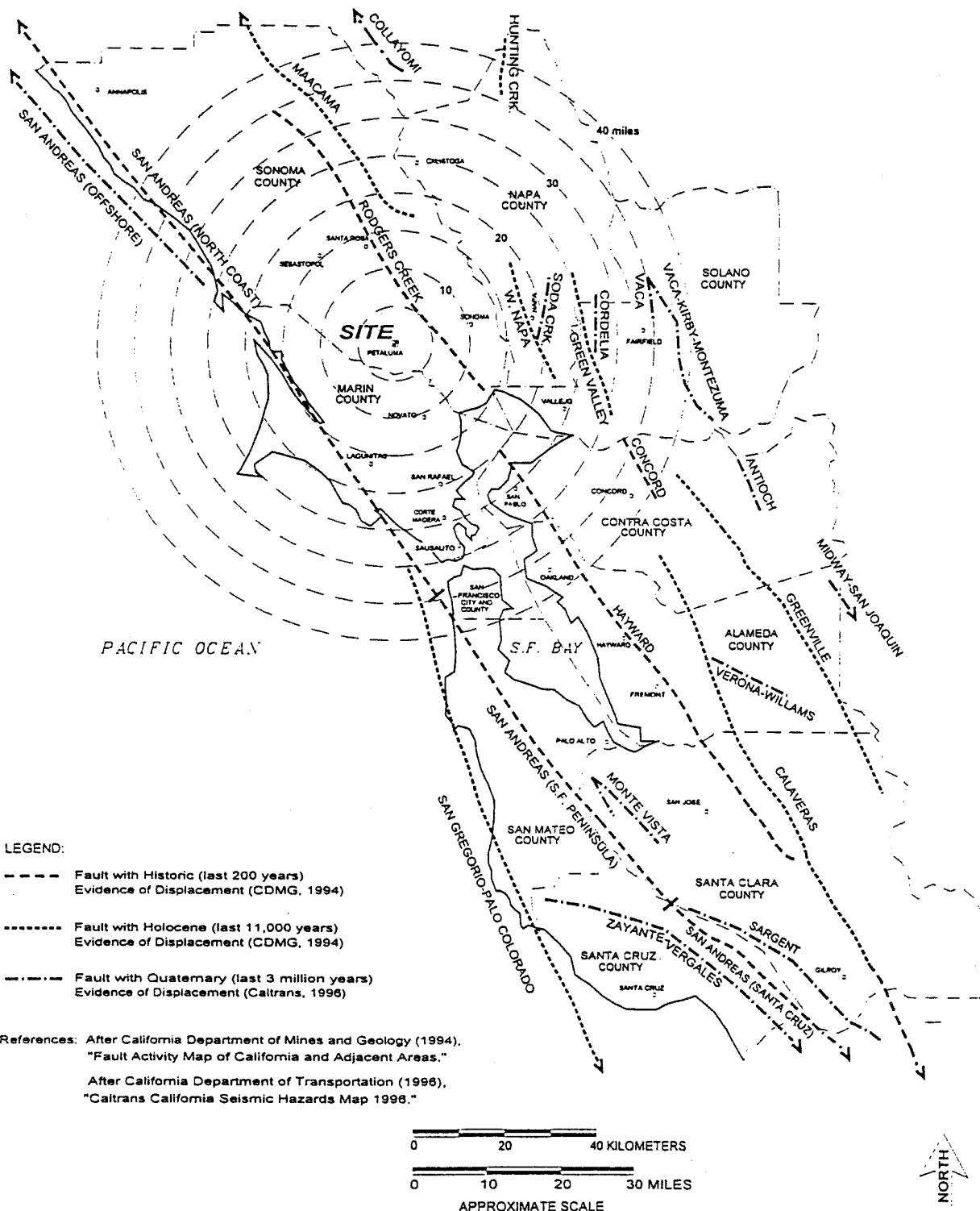
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Figure



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ACTIVE FAULT MAP
NWP Railroad Mainline Bridge
Petaluma, California

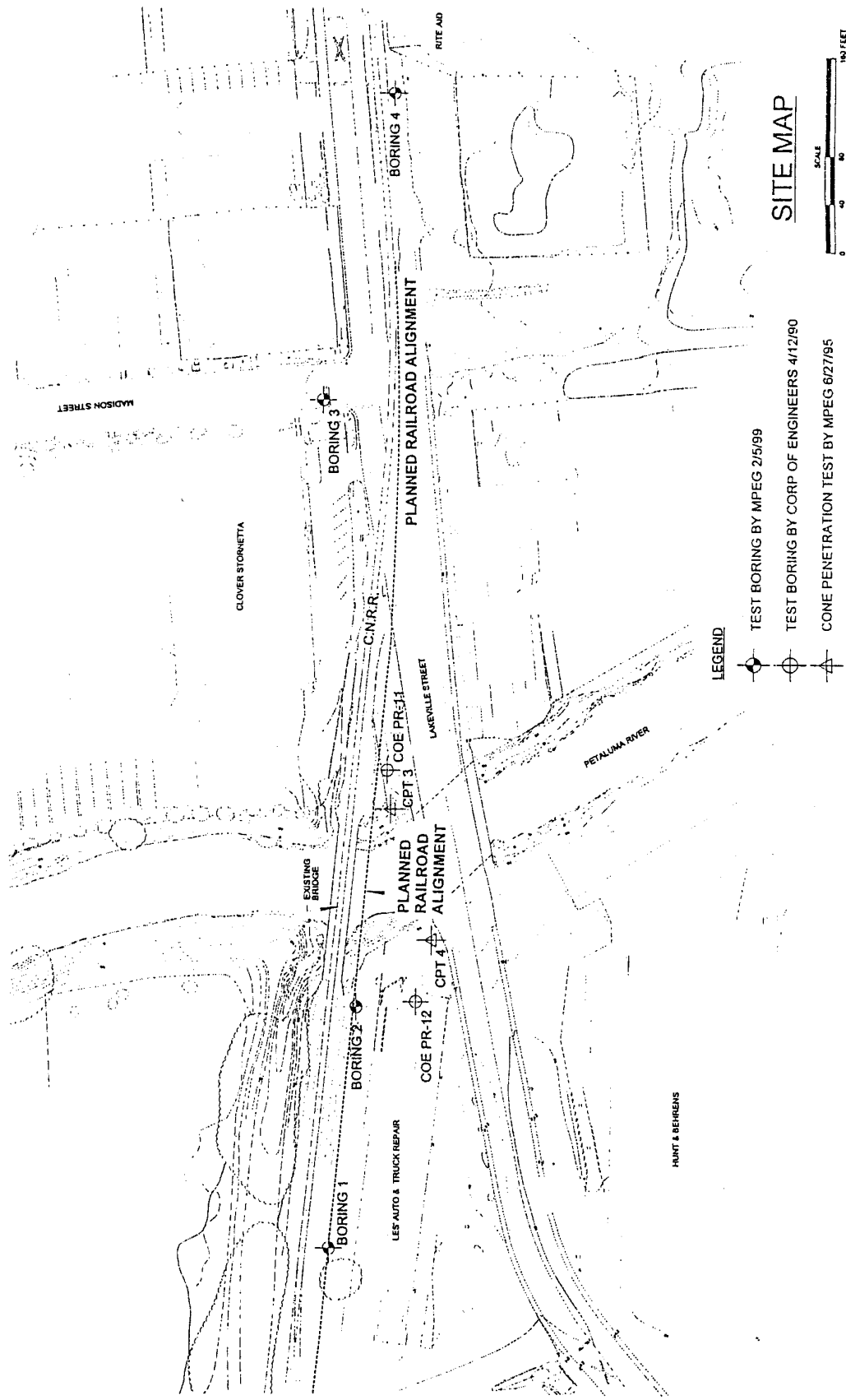
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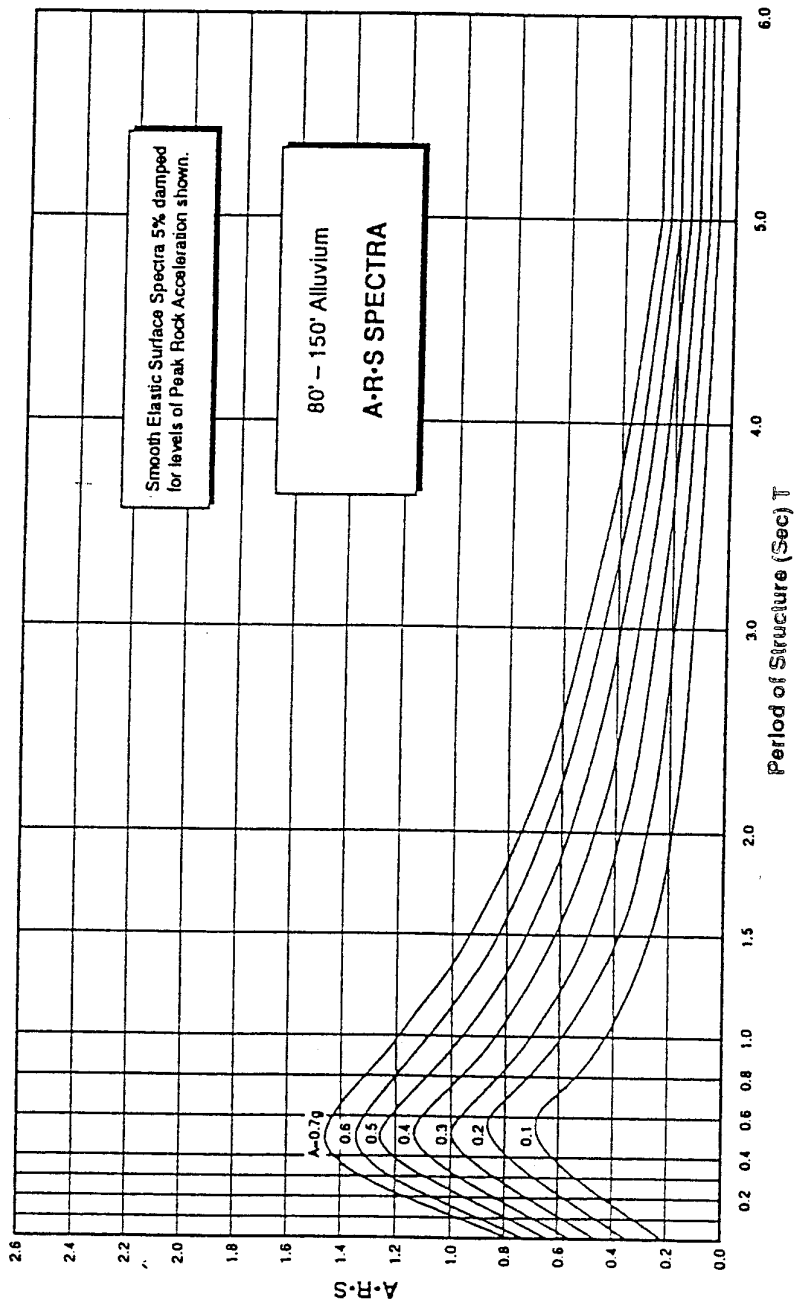
Figure



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Miller Pacific ENGINEERING GROUP		SITE MAP NWP Railroad Mainline Bridge Petaluma, California		3
Project No.	243.19	Date	2/26/99	Approved By
				4rc
				Figure

REFERENCE: WINZLER & KELLEY, MAINLINE RAILROAD BRIDGE REPLACEMENT
NORTH OF LAKEVILLE ST., 2/9/99



REFERENCE: Caltrans Bridge Design Specifications Manual, December, 1994.

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RECOMMENDED CALTRANS ARS CURVE
NWP Railroad Mainline Bridge
Petaluma, California

4

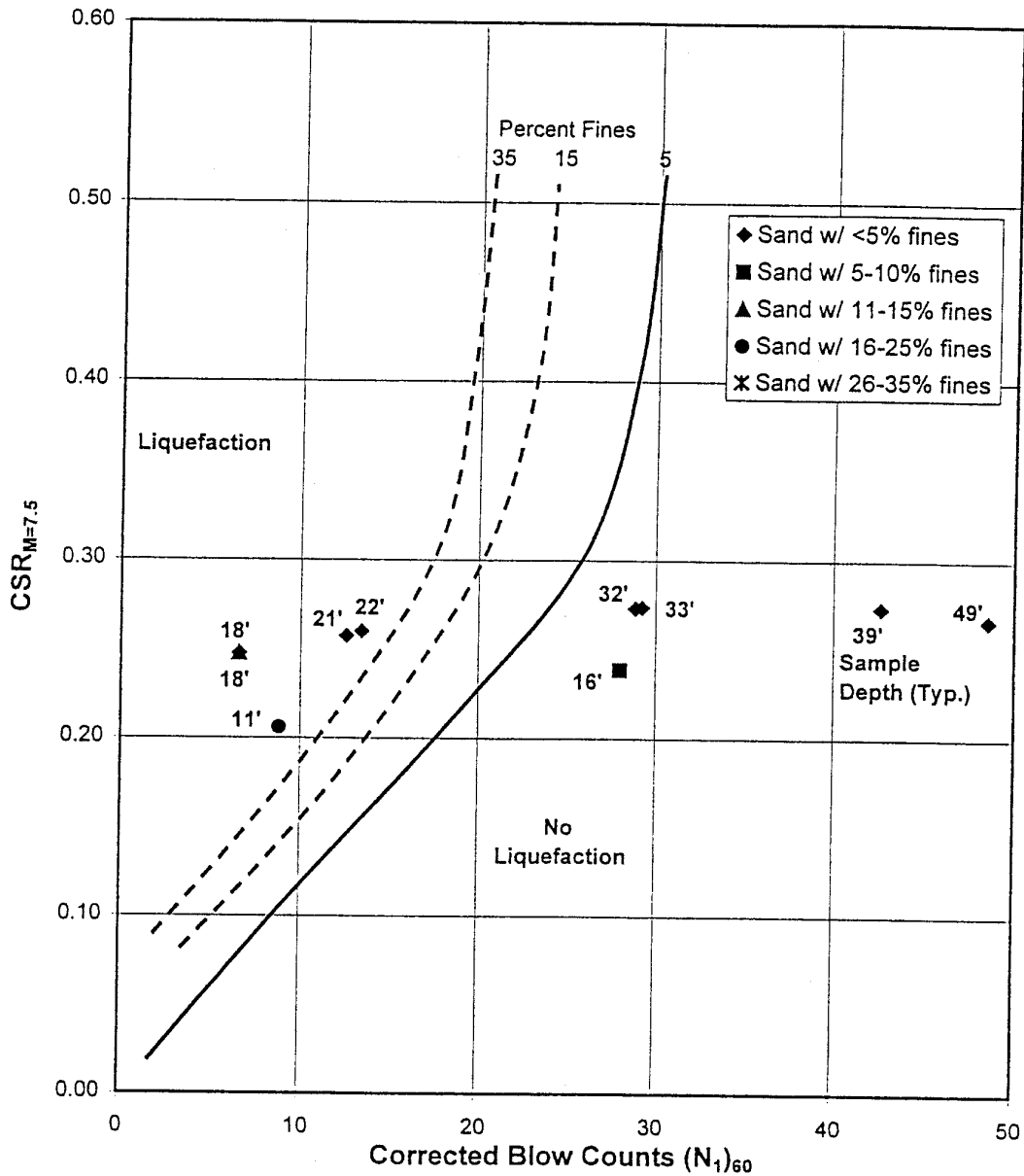
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Figure

Liquefaction Potential Chart **Cyclic Stress Ratio vs. Corrected Blow Counts**



Note: The data points are from a Magnitude 7.0 earthquake on the Rodgers Creek fault and have been modified to a magnitude 7.5 equivalent earthquake

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LIQUEFACTION EVALUATION
 NWP Railroad Mainline Bridge
 Petaluma, California

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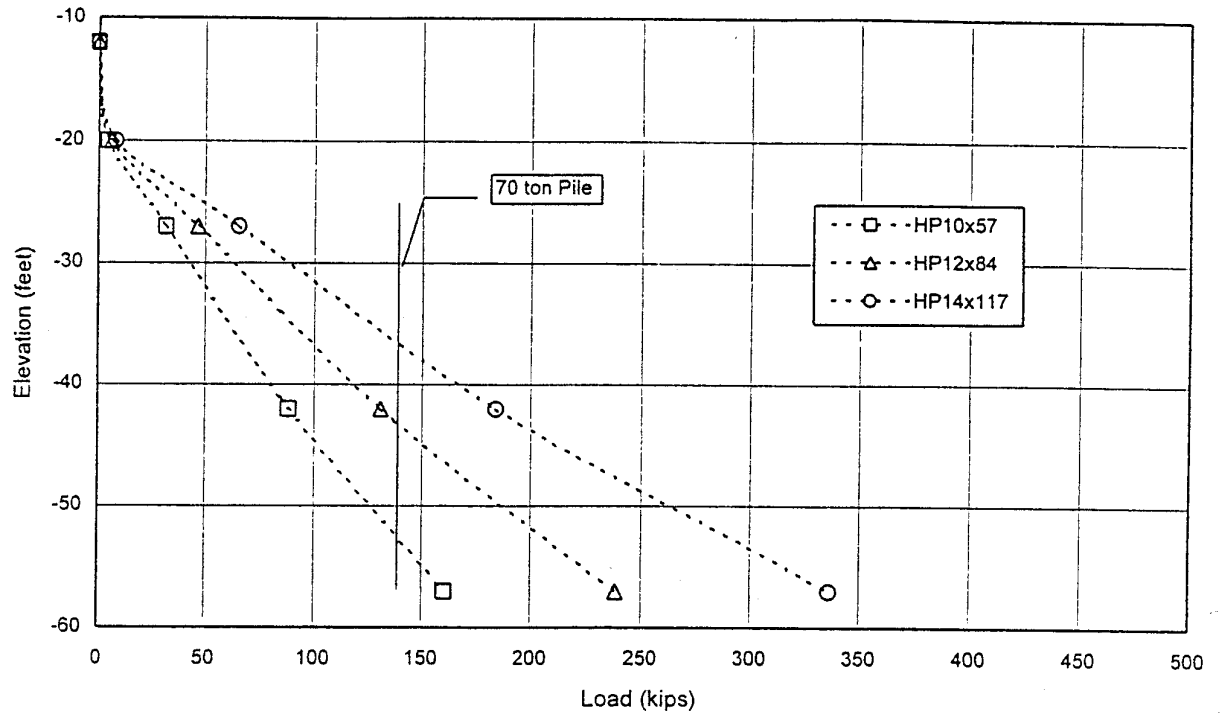
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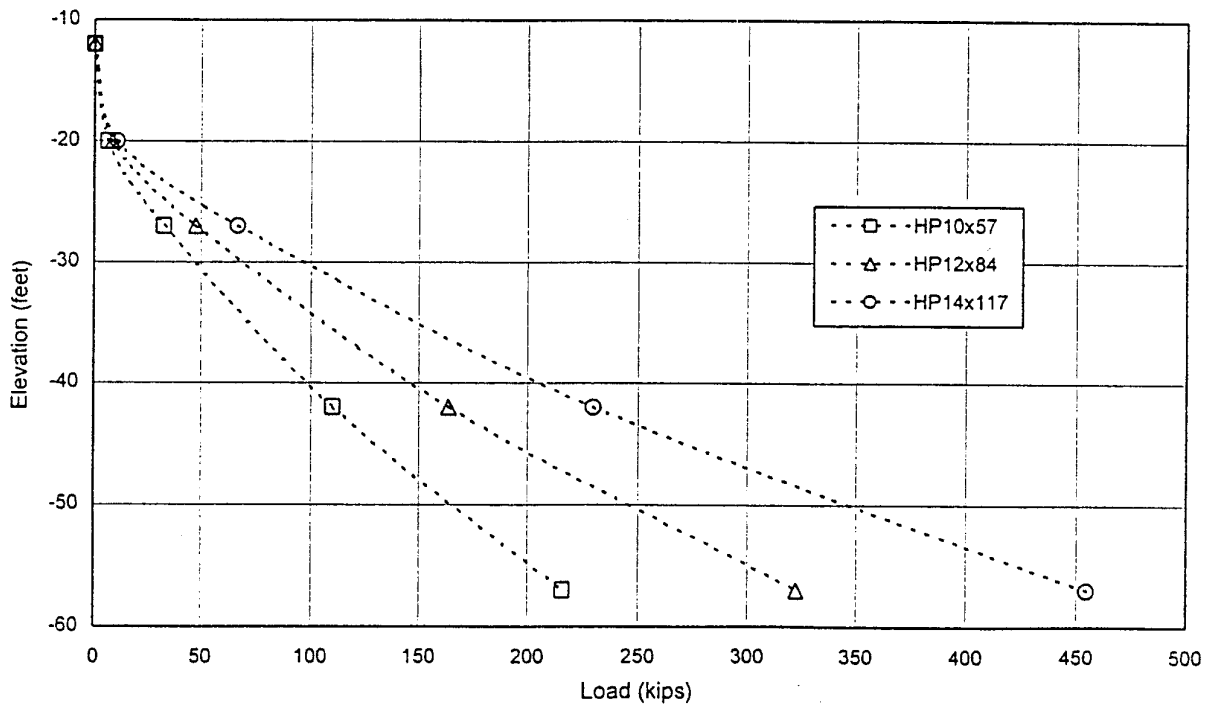
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Figure

Design Downward Capacity (FS=3)



Design Uplift Capacity (FS=2)



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VERTICAL PILE CAPACITY
NWP Railroad Mainline Bridge
Petaluma, California

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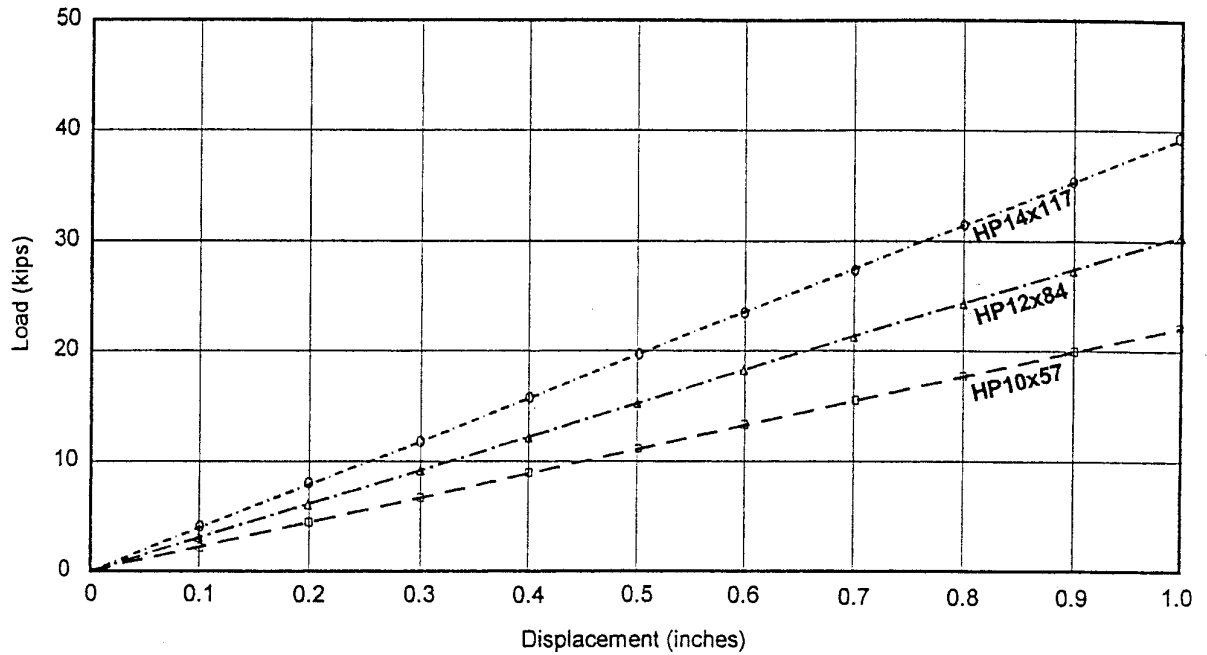
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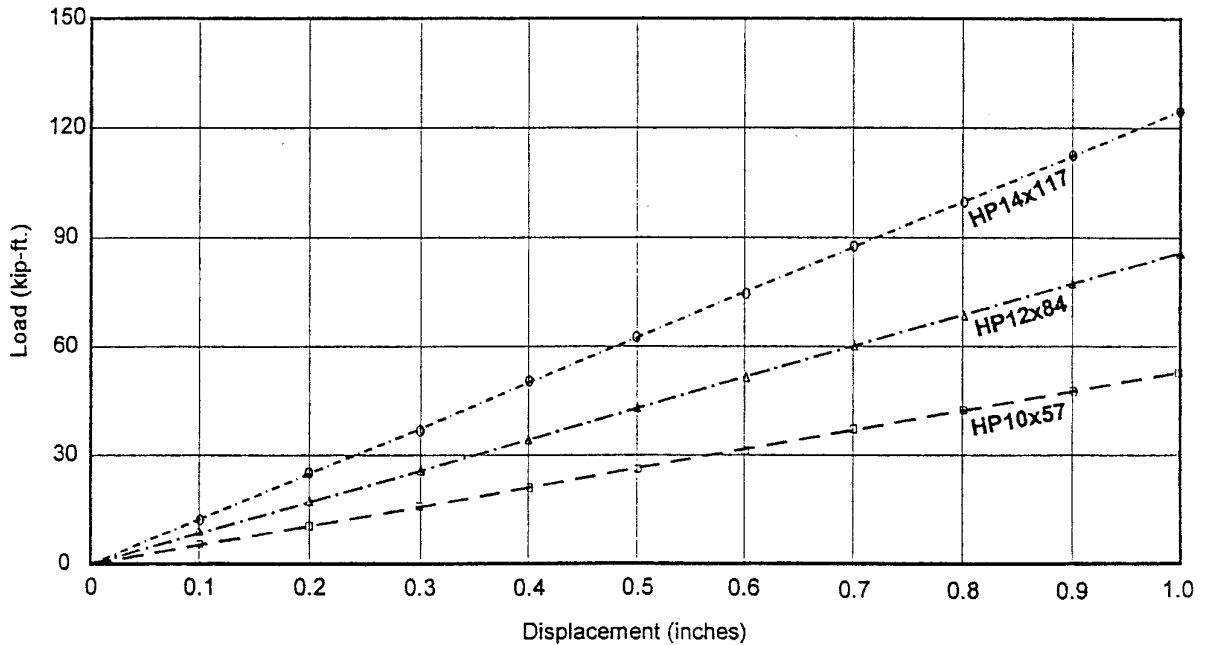
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Figure

Ultimate Lateral Capacity



Induced Maximum Moment



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LATERAL PILE CAPACITY AND
INDUCED MOMENT
NWP Railroad Mainline Bridge
Petaluma, California

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Figure

APPENDIX A

FIELD EXPLORATION AND LABORATORY TESTING

APPENDIX A

FIELD EXPLORATION AND LABORATORY TESTING

A. Test Borings and Sampling

Four test borings were drilled at the locations shown on Figure 3. The purpose of the test borings was to obtain physical samples for laboratory tests to determine the engineering properties of the subsurface soils and to verify soil types and physical parameters.

The drilling was conducted using both solid augers and rotary wash type equipment. Six-inch solid augers were used to drill and sample down to the groundwater level. Below the groundwater level rotary wash drilling was used. Rotary wash drilling consists of rotating a drill bit at the end of a drill rod and flushing the soil cuttings to the surface. Because a drilling fluid is employed with this method, the need for deep casing is eliminated when working below the water table. Moreover, the accumulation of cuttings at the bottom of the hole is reduced during the interval between drilling and sampling, and sloughing of the borehole sides is also reduced. This drilling method enables soil samples of high quality to be obtained when employed with the sampling equipment described below.

Two types of samplers were employed. In cohesive soils or where otherwise appropriate, a standard 2½-inch diameter "California sampler" was used. This sampler has a split barrel that contains thin-walled brass liner tubes and a bit with a sharpened cutting edge. The assembled sampler is lowered into the boring and driven 18 inches into the material at the bottom of the boring. The blow counts required to drive the sampler six inches are recorded. The total blow count for the last 12 inches is used as an indication of formation density or consistency. The sampler is then withdrawn from the boring and disassembled. The liners containing the soil "core" are removed, examined, trimmed and sealed with plastic caps to prevent moisture loss.

A 2-inch diameter Standard Penetration Test (SPT) sampler was employed in cohesionless soils. The assembled sampler is lowered into the boring and driven 18 inches into the material at the bottom of the boring. The blow counts required to drive the sampler six inches are recorded. The total blow count for the last 12 inches is used as an indication of formation density or consistency. The blow counts from the SPT sample are used in the evaluation of liquefaction potential. Since no liners are used with the SPT, the volume of sample obtained is measured in the field and placed in the sealed plastic bag for laboratory testing.

The drilling and sampling was done under the technical supervision of our engineer who examined and logged the soil materials encountered as the test borings were drilled. The soils encountered were classified in general accordance with the Unified Soil Classification System and ASTM Standard Practice D 2488, "description and Identification of Soils (Visual-Manual Procedure)." This classification system is summarized on Figure A-1, Soil Classification Chart and Key to Log Symbols. The subsurface conditions encountered in the test borings are summarized and presented on the boring logs, Figures A-2 through A-16.

B. Cone Penetration Tests (CPT)

The cone penetration test (CPT) is a specialized subsurface investigation tool. The CPT is unequalled with respect to delineation of soil stratigraphy, repeatability, accuracy, and the nearly continuous measurement of subsurface parameters.

In the cone penetration test, a cylindrical cone is mounted on the end of a series of rods and is pushed into the ground. The cone cylinder has a diameter of 35.6 mm. The base area of the cone tip is 10 sq cm with an apex angle of 60 degrees. The area of the friction sleeve surface is 150 sq cm. The cone is advanced at a constant rate of 2 cm/sec and intermittent measurements are made at 5 cm increments. Standard measurements include tip resistance, sleeve friction, pore pressure and inclination of the rods. These measurements are recorded by computer software, which converts electrical signals from strain gages and load cells in the friction sleeve and cone to physical values. This test method has been standardized and is described in detail by ASTM Standard Test Method D 3441, "Deep, Quasi-Static, Cone and Friction-Cone Penetration Tests of Soil."

We conducted cone penetration tests for previous flood control improvements at the locations shown on Figure 3. The tip resistance, friction ratio, and pore pressures measured in the field are presented in Figures A-17 and A-18. Interpreted soil type and blow counts are shown on Figures A-19. Interpreted soil strength is shown on Figures A-22.

C. Laboratory Testing Program

We reexamined the samples in the laboratory to confirm field classification and suitability for testing. A testing program was designed to obtain representative soil engineering properties, e.g., density, strength and compressibility.

Moisture content and dry density tests were performed on numerous samples since this data correlates well with other soil properties. The results of these tests are presented on the boring logs.

Strength tests consisted of unconfined compression (UC) tests. The shear strength results from the tests are also shown on the borings.

Sieve analyses and percent passing #200 sieve tests were conducted to determine grain size and the percent of fines (silt or clay) were conducted on both sandy and silty soils. The percent fines content was used in our liquefaction analyses. The results of the percent passing #200 sieve (P_{200}) are shown on the boring logs. The results of the sieve analyses are plotted on Figure A-21.

Laboratory testing was conducted in general accordance with the following ASTM Standard Test Methods (ASTM, 1990) or U.S. Corps of Engineers procedures:

Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures, ASTM D 2216;

Density of Soil in Place by the Drive-Cylinder Method, ASTM D 2937;

Amount of Material in Soils Finer than the No. 200 (75- μ m), ASTM D 1140;

Unconfined Compressive Strength of Cohesive Soil, ASTM D 2166;

Particle-Size Analysis of Soils, ASTM D 422.

The test boring logs, description of soils encountered and the laboratory test data reflect conditions only at the location of the test borings or sampling at the time they were retrieved. Conditions may differ at other locations and may change with the passage of time due to a variety of causes including natural weathering, climate and changes in surface and subsurface drainage.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS		SYMBOL	DESCRIPTION
COARSE GRAINED SOILS over 50% sand and gravel	CLEAN GRAVEL	GW	Well-graded gravels or gravel sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel sand mixtures, little or no fines
	GRAVEL with fines	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	CLEAN SAND	SW	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
	SAND with fines	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS over 50% silt and clay	SILT AND CLAY, liquid limit < 50%	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	SILT AND CLAY, liquid limit > 50%	MH	Inorganic silts, micaceous or diatomaceous fines sands or silts, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS		PT	Peat, muck, and other highly organic soils
ROCK			Undifferentiated as to type or composition

KEY TO BORING AND TEST PIT SYMBOLS

CLASSIFICATION TESTS

AL ATTERBERG LIMITS TEST
 SA SIEVE ANALYSIS
 HYD HYDROMETER ANALYSIS
 P200 PERCENT PASSING #200 SIEVE
 P4 PERCENT PASSING #4 SIEVE

STRENGTH TESTS

TV FIELD TORVANE (UNDRAINED SHEAR)
 UC LABORATORY UNCONFINED COMPRESSION
 TXCU CONSOLIDATED UNDRAINED TRIAXIAL
 TXUU UNCONSOLIDATED UNDRAINED TRIAXIAL
 UC, CU, UU = 1/2 Deviator Stress

SAMPLER TYPE

UNDISTURBED CORE SAMPLE:
 MODIFIED CALIFORNIA OR
 HYDRAULIC PISTON SAMPLE

X DISTURBED OR BULK SAMPLE

STANDARD PENETRATION
 TEST SAMPLE

ROCK OR CORE SAMPLE

NOTE: Test boring and test pit logs are an interpretation of conditions encountered at the locations and time of exploration. Subsurface rock, soil and water conditions may differ in locations and with the passage of time. Lines defining the interface between differing soil or rock description are approximate and may indicate gradual transition

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SOIL CLASSIFICATION CHART
 NWP Railroad Mainline Bridge
 Petaluma, California

A-1

Project No. 243.19

Date 2/26/99

Approved By: *gts*

Figure

BORING 1					
EQUIPMENT: 6-inch Solid Auger					
DATE: February 5, 1999					
ELEVATION: +10.6 Feet*					
*REFERENCE: Winzler & Kelly, Topographic Map, 1999					
OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters feet
					0 0
	210 (UC)	20	17.6	98	1
		68	13.3	113	5
					2
					3 10
		13			4
					15
					5
					6 20
CLAYEY SAND (SC) moist, soft to medium dense, with fine gravels, mottled rust and dark gray (Fill)					
grades to more gravel, less sand, medium dense					
lense of cobbles at 6 feet					
SILTY CLAY (CL-CH) moist, stiff, odor, dark gray (Alluvium)					
water seeping into hole at 8 feet during drilling					
water at 9.5 feet after drilling					
Bottom at 10.5 feet, water at 9.5 feet after drilling					

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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
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BORING LOG
NWP Railroad Mainline Bridge
Petaluma, California

A-2

Project
No. 243.19

Date 2/26/99

Approved
By: 

Figure

OTHER TEST DATA					BORING 2	
UNDRAINED SHEAR STRENGTH psf (1)					EQUIPMENT: 6-inch Solid Auger	
BLOWS PER FOOT					DATE: February 5, 1999	
MOISTURE CONTENT (%)					ELEVATION: +10.3 Feet*	
DRY UNIT WEIGHT pcf (2)					*REFERENCE: Winzler & Kelly, Topographic Map, 1999	
CONSL	550 (UC)	26	24.7	95	0 meters	SAMPLE
					0 feet	
	320 (UC)	15	31.7	87	1	SYMBOL (3)
					5	
	8	44.4	74	10	2	
					3	
	41	22.5	101	15	4	
					5	
SA P200= 9.3					6	
					20	

SANDY CLAY (CL)
moist, medium stiff to stiff, with fine gravels,
mottled rust and dark gray (Fill)

SILTY CLAY (CL-CH)
moist, soft to medium stiff, with little fine sand,
dark gray (Alluvium)

drilling soft

water at 6.5 feet during drilling

contamination on augers beginning at 8 feet

SANDY CLAY (CL-CH)
wet, soft to medium stiff, odor, dark gray
(Alluvium)

drilling soft

SILTY SAND (SP-SM)
wet, medium dense, occasional fine gravels, dark
gray (Alluvium)

drilling soft

SANDY GRAVEL (GW)
wet, loose to medium dense, dark gray (Alluvium)

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG
NWP Railroad Mainline Bridge
Petaluma, California



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Project
No. 243.19

Date 2/26/99

Approved
By: *JK*

Figure

BORING 2 (CONTINUED)						
OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters feet	SAMPLE SYMBOL (3)
SA P200= 4.9		20			20	 SANDY GRAVEL (GW) wet, loose to medium dense, dark gray (Alluvium)
		83/11"	10.0	126	7	
					25	
					8	grades medium dense to dense
						drilling loose
					9	 CLAYEY SAND (SC) moist, very dense, fine sand, with clayey fines, light brown (Alluvium)
		50/3"	20.6	107	30	
					10	
					35	
SA P200= 19.4		83	21.7		11	
					37	
					40	
		50/5"	11.3			with some coarse sand and fine gravel, olive gray
						Bottom at 41.0 feet, water at 10 feet after drilling

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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
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BORING LOG
NWP Railroad Mainline Bridge
Petaluma, California

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Project
No. 243.19

Date 2/26/99

Approved
By: 

Figure

OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	BORING 3		
					DEPTH	SAMPLE	SYMBOL (3)
					0 meters 0 feet		
							3 inches asphalt concrete, 6 inches aggregate base
		34	6.5	103			SANDY GRAVEL (GM) moist, medium dense to dense, brown (Fill)
		16	5.8	109	1 5		POORLY-GRADED SAND (SP) moist, medium dense, brown (Trench Sand)
					2		
		17	22.9	103	3 10		CLAYEY SAND (SC) moist, medium dense, dark gray (Fill)
							Bottom at 10.5 feet, no water encountered
					4		
					15		
					5		
					6 20		

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
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BORING LOG
NWP Railroad Mainline Bridge
Petaluma, California

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Project No. 243.19

Date 2/26/99

Approved By: *gt*

Figure

BORING 4					
EQUIPMENT: 6-inch Solid Auger					
DATE: February 5, 1999					
ELEVATION: +13.3 Feet*					
*REFERENCE: Winzler & Kelly, Topographic Map, 1999					
OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters feet
					0 0
		50 1/2"	7.9	106	1
		57	19.5	104	5
		35	19.1	103	2
		57	18.0	106	3 10
					4
					15
					5
					6 20

2 inches asphalt concrete, 4 inches aggregate base

GRAVELLY SAND (SW)
moist, very, dark brown with gravels to 1-1/2 inch (Fill)

CLAYEY SAND (SC)
moist, very dense, mottled rust and brown (Alluvium)

grades to fine sand with trace of clayey fines, moist to wet, medium dense to dense

Bottom at 10.5 feet, no water encountered

NOTES: (1) METRIC EQUIVALENT STRENGTH (kPa) = 0.0479 x STRENGTH (psf)
(2) METRIC EQUIVALENT DRY UNIT WEIGHT kN/m³ = 0.1571 x DRY UNIT WEIGHT (pcf)
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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BORING LOG
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Petaluma, California

A-6

Project No. 243.19

Date 2/26/99

Approved By: *SA*

Figure

COE BORING PR-11 (CONTINUED)							
OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters DEPTH feet	SAMPLE	SYMBOL (3)
					20		
					7		
		40			25		
					8		
					9		
					30		
					10		
	2400 (DS)	33			35		
					11		
					12		
		51			40		

SILTY/CLAYEY SAND (SM/SC)
fat clay with sand, same color, wet, clay, 15% fine sand

LEAN CLAY (CL)
gray, moist, fine to coarse sand, 10% rounded gravel to 1-inch dia.
well graded Sand, gray, moist, fine to coarse sand, 10% rounded gravel to 1-inch dia.
well graded Sand, grayish brown, moist, medium sand, 20% coarse sand, 10% rounded gravel to 0.5-inch dia.

POORLY GRADED SAND (SP)
grayish brown, moist, medium and fine sand

well graded Sand, 15% coarse sand, 10% subrounded gravel to 0.5-inch dia.

NOTES: (1) METRIC EQUIVALENT STRENGTH IS 0.0479 kPa
(2) METRIC EQUIVALENT DRY UNIT WEIGHT IS 0.1571 kN/m³
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NWP Railroad Mainline Bridge
Petaluma, California

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Project
No. 243.19

Date 2/26/99

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By: *gws*

Figure

COE BORING PR-11 (CONTINUED)							
OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters DEPTH feet	SAMPLE	SYMBOL (3)
					40		POORLY GRADED SAND (SP) 10% coarse sand
		65/6"			13		
					45		
					14		interbeds of well graded sand, 15% coarse sand, 10% subrounded gravel to 3/8-inch dia.
	2200 (DS)	64			15		
					50		
					16		3-inch interbed of well graded sand, 50% coarse sand, 30% medium sand, 10% gravel
		50			55		
					17		
					18		interbed of well graded sand, 25% medium sand, 25% coarse sand, 25% sub-rounded gravel to 1/8-inch dia.
		71			60		
(continued)							

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NOTES: (1) METRIC EQUIVALENT STRENGTH IS 0.0479 kPa
(2) METRIC EQUIVALENT DRY UNIT WEIGHT IS 0.1571 kN/m³
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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CORPS OF ENGINEERS BORING LOG
NWP Railroad Mainline Bridge
Petaluma, California

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Project
No. 243.19

Date 2/26/99

Approved
By: *JS*

Figure

COE BORING PR-11 (CONTINUED)							
OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters DEPTH feet	SAMPLE	SYMBOL (3)
		67/11"			60		POORLY GRADED SAND (SP) interbed of well graded sand, 25% medium sand, 25% coarse sand, 25% sub-rounded gravel to 1/8-inch dia.
					19		WELL GRADED SAND (SW) grayish brown and light olive brown, wet, 40% medium sand, 40% coarse sand, 15% rounded gravels to 0.5-inch diameter, 5% clay
		72/11"			65		
					20		
					21		poorly graded sand, grayish brown, wet, medium and fine sand
					70		
		85/11"			22		4-inch interbed of well graded sand with gravel, 60% coarse sand, 30% medium sand, 20% gravel
					75		
					23		
					24		poorly graded sand, light olive brown, wet, medium sand, medium compaction
					80		SILTSTONE (continued)

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NOTES: (1) METRIC EQUIVALENT STRENGTH IS 0.0479 kPa
(2) METRIC EQUIVALENT DRY UNIT WEIGHT IS 0.1571 kN/m³
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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CORPS OF ENGINEERS BORING LOG
NWP Railroad Mainline Bridge
Petaluma, California

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By: *[Signature]*

Figure

OTHER TEST DATA		UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters feet	DEPTH	SAMPLE	SYMBOL (3)	COE BORING PR-11 (CONTINUED)	
						80				SILTSTONE	
										light olive brown, dry, strong compaction	
			83/11"			25				POORLY GRADED SAND (SP)	
										light olive brown, wet, 80% medium sand, 20% fine sand, weak compaction	
			63			85				POORLY GRADED SAND (SP)	
						26				light blue gray, wet, medium sand, 10% fine sand, 10% clay, trace coarse sand	
						27				dark greenish gray, dry, 30% clay, low plasticity, medium compaction	
						90					
						28					
						29					
						95					
						30					
			50/6"			100				LEAN CLAY (CL)	
										dark greenish gray, very moist, clay, 20% silt, firm	
										Bottom of Boring at 100 feet	

NOTES: (1) METRIC EQUIVALENT STRENGTH IS 0.0479 kPa
(2) METRIC EQUIVALENT DRY UNIT WEIGHT IS 0.1571 kN/m³
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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ENGINEERING GROUP

CORPS OF ENGINEERS BORING LOG
NWP Railroad Mainline Bridge
Petaluma, California

A-11

Project
No. 243.19

Date 2/26/99

Approved
By: *[Signature]*

Figure

COE BORING PR-12					
EQUIPMENT: 8-inch Rotary Wash					
DATE: April 12, 1990					
ELEVATION: +13.0 Feet*					
*REFERENCE: Winzler and Kelly Topographic Map					
OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	DEPTH meters feet SAMPLE SYMBOL (3)
LL=34, PI=15 (AL)					0 0
					1
LL=42, PI=25 (AL)					5
					2
		7			3 10
					4
		5			15
					5
		6			6
					20
(continued)					

NOTES: (1) METRIC EQUIVALENT STRENGTH IS 0.0479 kPa
(2) METRIC EQUIVALENT DRY UNIT WEIGHT IS 0.1571 kN/m³
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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NWP Railroad Mainline Bridge
Petaluma, California

A-12

Project No. 243.19

Date 2/26/99

Approved By: *gts*

Figure

COE BORING PR-12 (CONTINUED)							
OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters feet	DEPTH	SAMPLE SYMBOL (3)
		13			20		SILTY SAND (SM) very dark gray, wet, rounded gravels to 0.25-inch dia., 40% coarse and medium sand, 5% clay
					7		
					25		WELL GRADED SILTY SAND W/GRAVEL (SW-SM) very dark gray, wet, rounded coarse to fine sand, 20% rounded gravel to 1.5-inch dia.
					8		
					9		
					30		POORLY GRADED SAND (SP) grayish brown, moist, medium sand, 40% fine sand interbed of silty sand, low plasticity, firm
	2400 (DS)	32			10		
					35		FAT CLAY WITH SAND (CH) brown, wet, clay, 20% fine sand, high plasticity, trace broken rounded gravel to 2-inch dia.
					11		POORLY GRADED SAND (SP) light yellowish-brown, moist, fine and medium sand
					12		
					40		

NOTES: (1) METRIC EQUIVALENT STRENGTH IS 0.0479 kPa
(2) METRIC EQUIVALENT DRY UNIT WEIGHT IS 0.1571 kN/m³
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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NWP Railroad Mainline Bridge
Petaluma, California

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Project
No. 243.19

Date 2/26/99

Approved
By: *JS*

Figure

COE BORING PR-12 (CONTINUED)									
OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters DEPTH feet	SAMPLE	SYMBOL (3)		
	2200 (DS)	66			40			POORLY GRADED SAND (SP) light yellowish-brown, moist, fine and medium sand	
		68			45			well graded sand interbed	
		40			50				
		76			55			WELL GRADED SAND WITH GRAVEL (SW) brown, wet, coarse sand, 30% fine sand, 15% gravel to 1-inch dia., larger gravels to 1.5-inch dia.	
					60			(continued)	

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NOTES: (1) METRIC EQUIVALENT STRENGTH IS 0.0479 kPa
(2) METRIC EQUIVALENT DRY UNIT WEIGHT IS 0.1571 kN/m³
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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CORPS OF ENGINEERS BORING LOG
NWP Railroad Mainline Bridge
Petaluma, California

A-14

Project No. 243.19

Date 2/26/99

Approved By: *STB*

Figure

COE BORING PR-12 (CONTINUED)							
OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters DEPTH feet	SAMPLE	SYMBOL (3)
		70/11"			60		WELL GRADED SAND WITH GRAVEL (SW) brown, wet, coarse sand, 30% fine sand, 15% gravel to 1-inch dia., larger gravels to 1.5-inch dia.
					19		
		81/11"			65		
					20		
					21		20% rounded gravel to 3/4-inch dia.
		90			70		
					22		
					22		
					75		4-inch interbed of well graded sand with gravel, 60% coarse sand, 30% medium sand, 20% gravel
		75/11"			23		
					23		POORLY GRADED SAND WITH SILT (SP) light brownish gray, moist, fine sand, 25% silt
					24		
					80		WELL GRADED SAND WITH CLAY (SW) light brownish gray, dry, medium and coarse sand, 10% clay, trace rounded gravels, strong compactio
							(continued)

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NOTES: (1) METRIC EQUIVALENT STRENGTH IS 0.0479 kPa
(2) METRIC EQUIVALENT DRY UNIT WEIGHT IS 0.1571 kN/m³
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY


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NWP Railroad Mainline Bridge
Petaluma, California


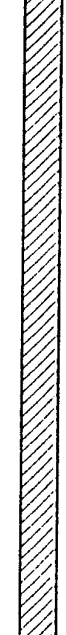

A-15

Project
No. 243.19

Date 2/26/99

Approved
By: 

Figure

COE BORING PR-12 (CONTINUED)						
OTHER TEST DATA	UNDRAINED SHEAR STRENGTH psf (1)	BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT pcf (2)	meters feet	SAMPLE SYMBOL (3)
		72			80	
					25	
					85	
		30/5.5"			26	
					27	
					90	
					28	
					95	
					29	
					30	
					100	
Bottom of Boring at 100 feet						

NOTES: (1) METRIC EQUIVALENT STRENGTH IS 0.0479 kPa
(2) METRIC EQUIVALENT DRY UNIT WEIGHT IS 0.1571 kN/m³
(3) GRAPHIC SYMBOLS ARE ILLUSTRATIVE ONLY

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NWP Railroad Mainline Bridge
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A-16

Project No. 243.19

Date 2/26/99

Approved By: 

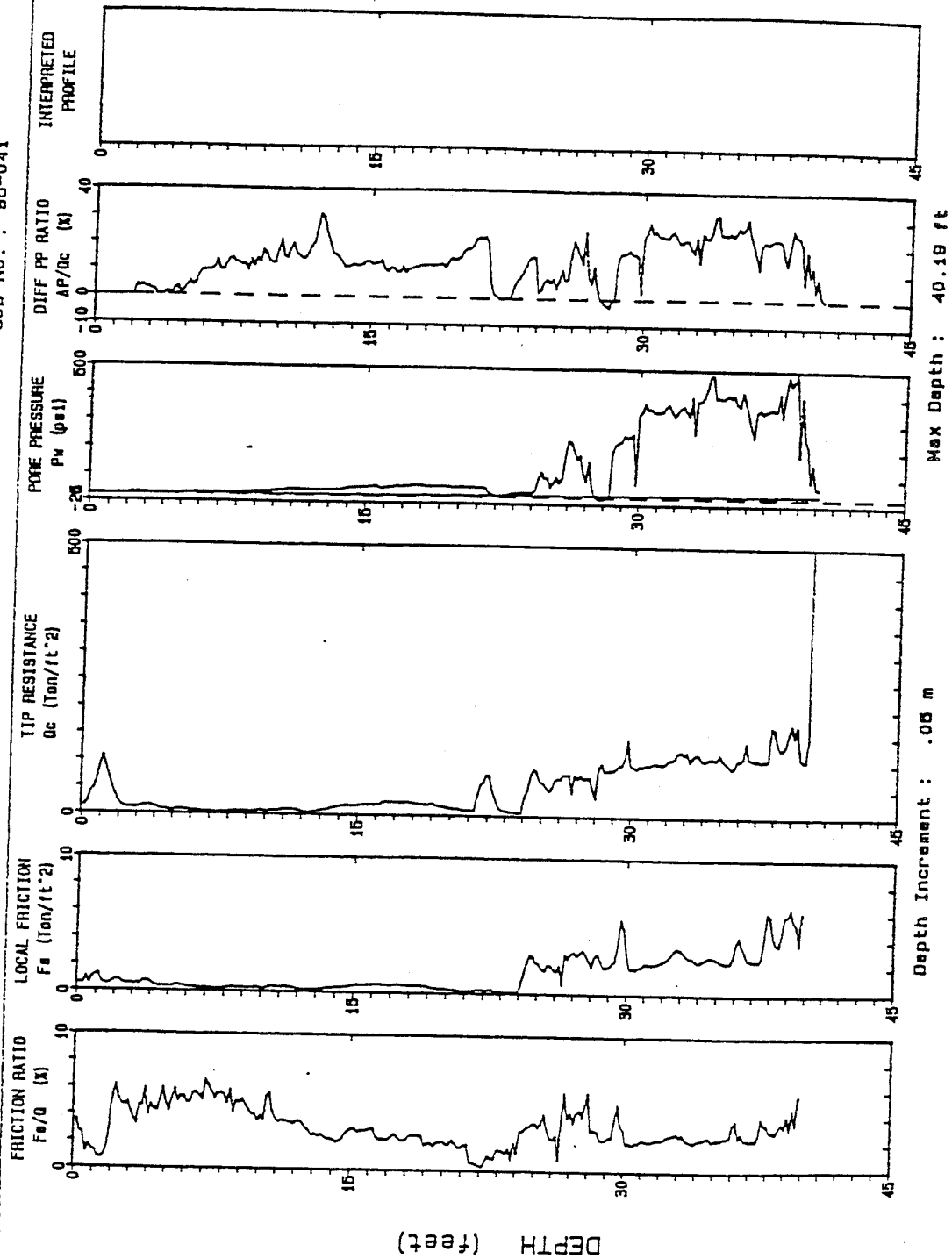
Figure

V B I

Operator : VIRGIL A. BAKER
 Location : CPT-3

CPT Date : 06-27-96 10:41
 Cone Used : HD 322 -U2

Sounding : 95Z065 Pg 1 / 1
 Job No. : 95-041



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CPT-3 FIELD DATA
 NWP Railroad Mainline Bridge
 Petaluma, California

A-17

Project No. 243.19

Date 2/26/99

Approved By: *[Signature]*

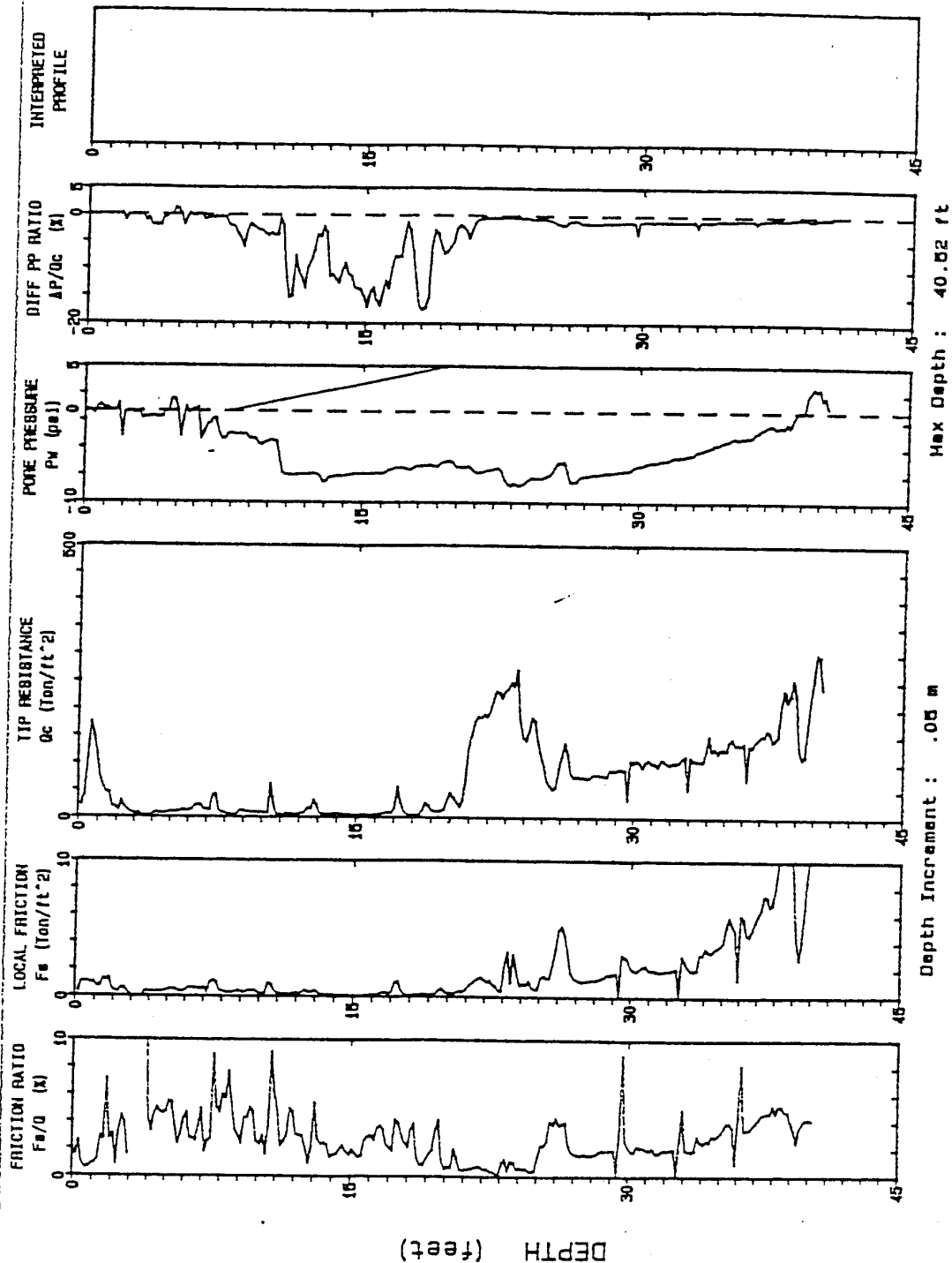
Figure

V B I

Operator : VIRGIL A. BAKER
Location : CPT-4

Sounding : 98Z068 Pg 1 / 1
Job No. : 98-041

CPT Date : 08-27-98 12:18
Cone Used : H0 322 -U2



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CPT-4 FIELD DATA
NWP Railroad Mainline Bridge
Petaluma, California

A-18

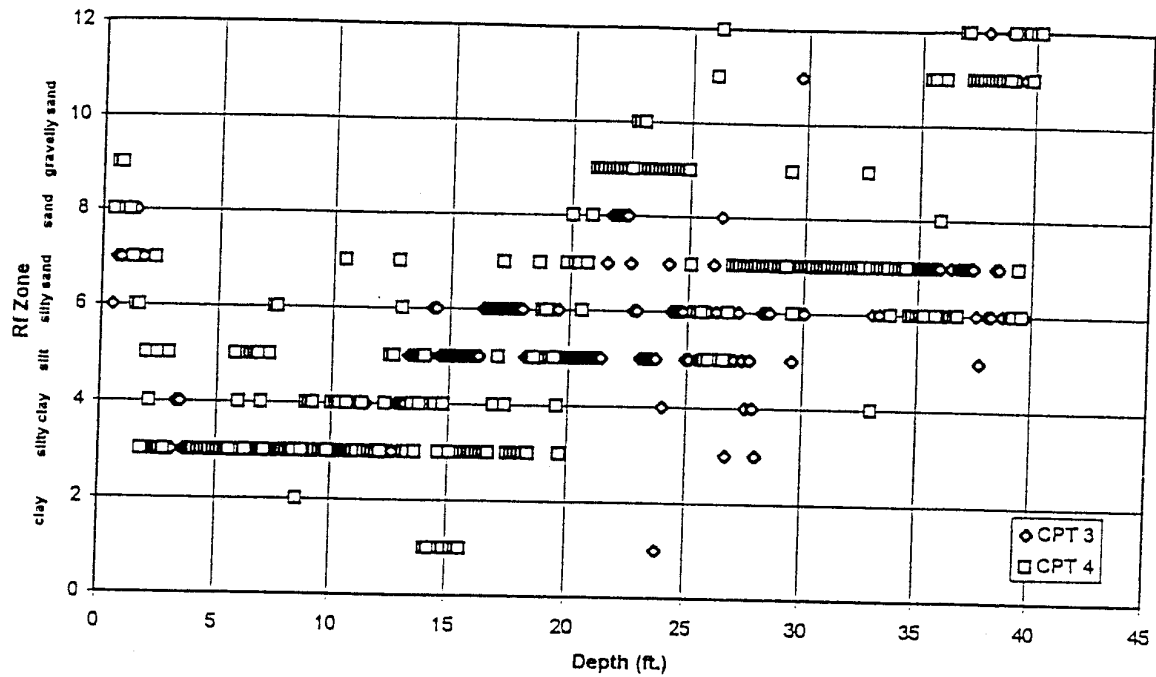
Project No. 243.19

Date 2/26/99

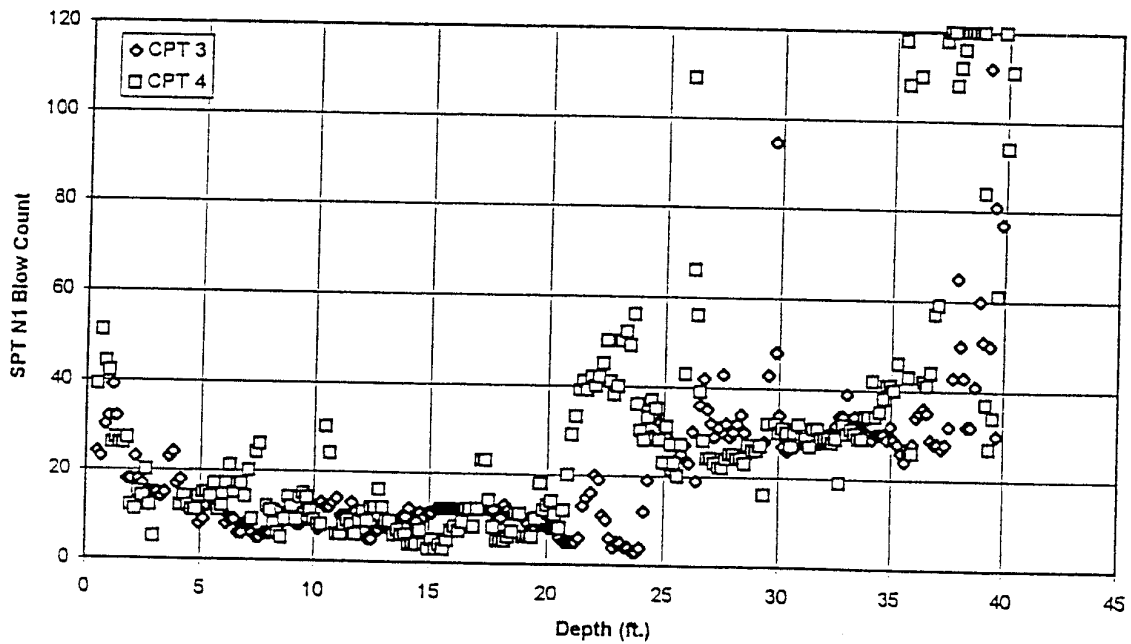
Approved By: *gms*

Figure

Rf Zone vs Depth



SPT N1 Blow Counts vs. Depth



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CPT INTERPRETED DATA
NWP Railroad Mainline Bridge
Petaluma, California

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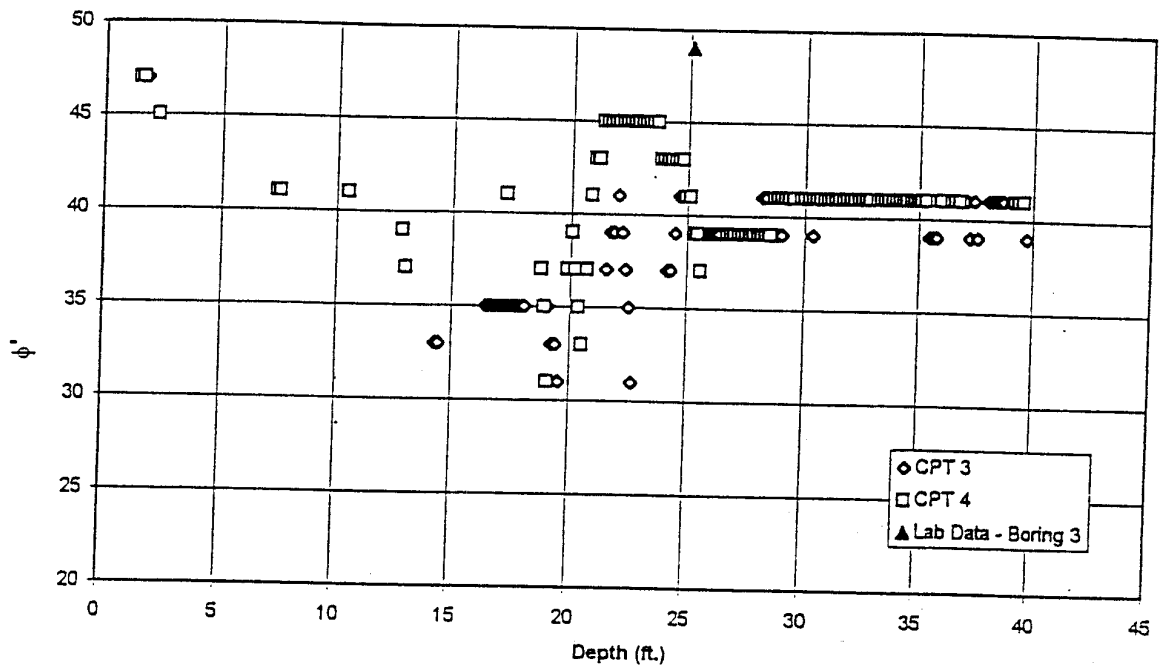
Project No. 243.19

Date 2/26/99

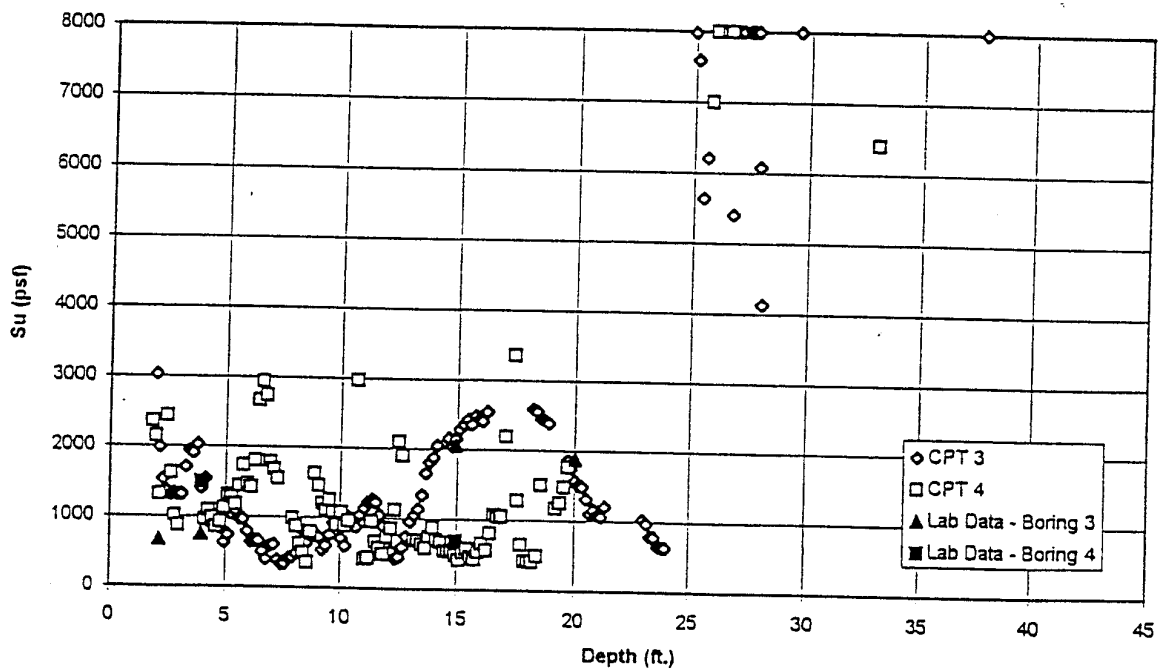
Approved By: *gts*

Figure

Friction Angle vs. Depth



Undrained Shear Strength vs. Depth



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 Petaluma, California

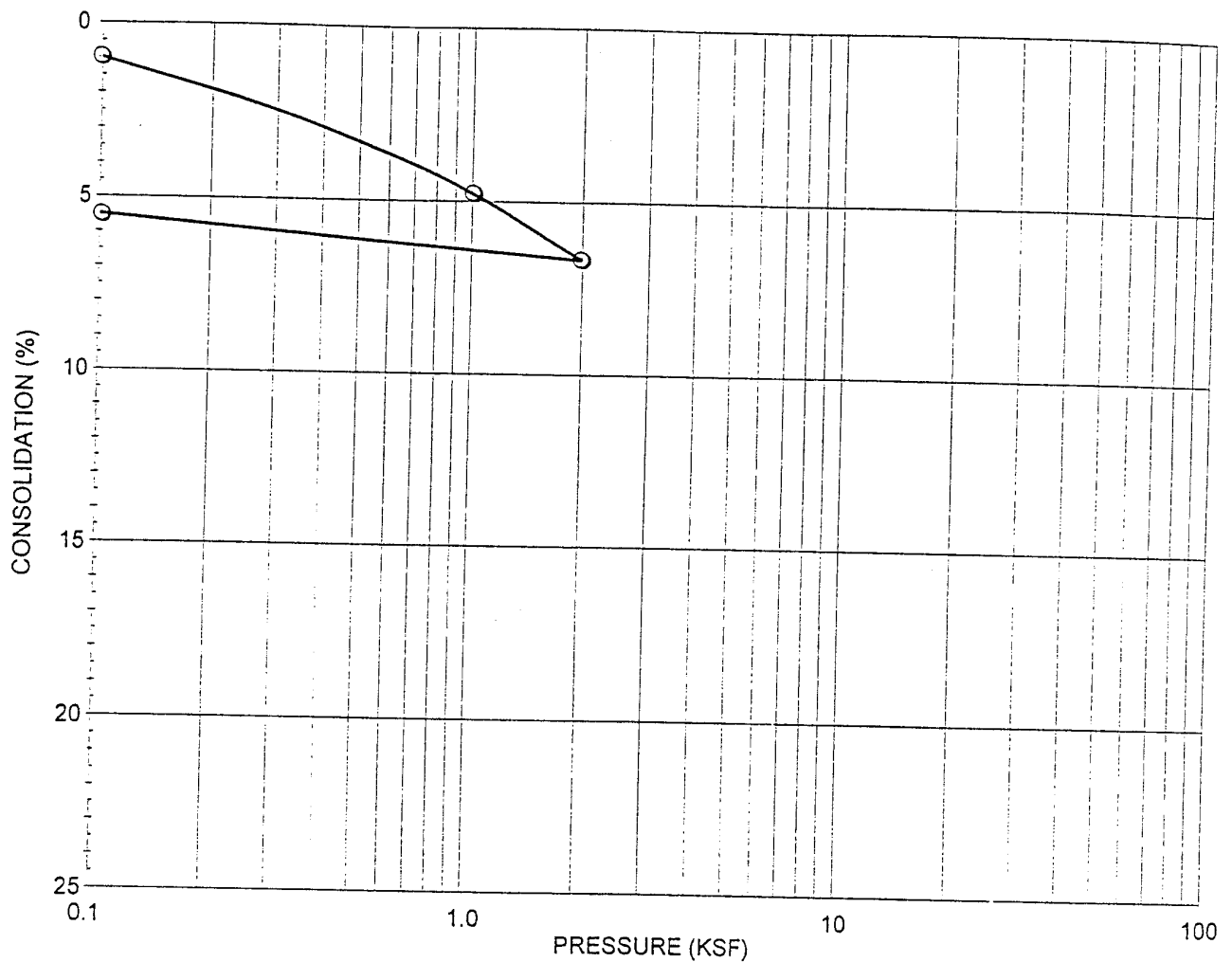
A-20

Project No. 243.19

Date 2/26/99

Approved By: *gts*

Figure



Boring No: 2			Depth: 6.0 feet		
Classification: Dark Gray Silty Clay (CL-CH)					
	Water Content (%)	Dry Density (pcf)	Saturation (%)	Height (in.)	Diameter (in.)
Initial	31.7	87.0		1.000	2.416
Final	39.0	81.3	100	0.948	

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CONSOLIDATION TEST
NWP Railroad Mainline Bridge
Petaluma, California

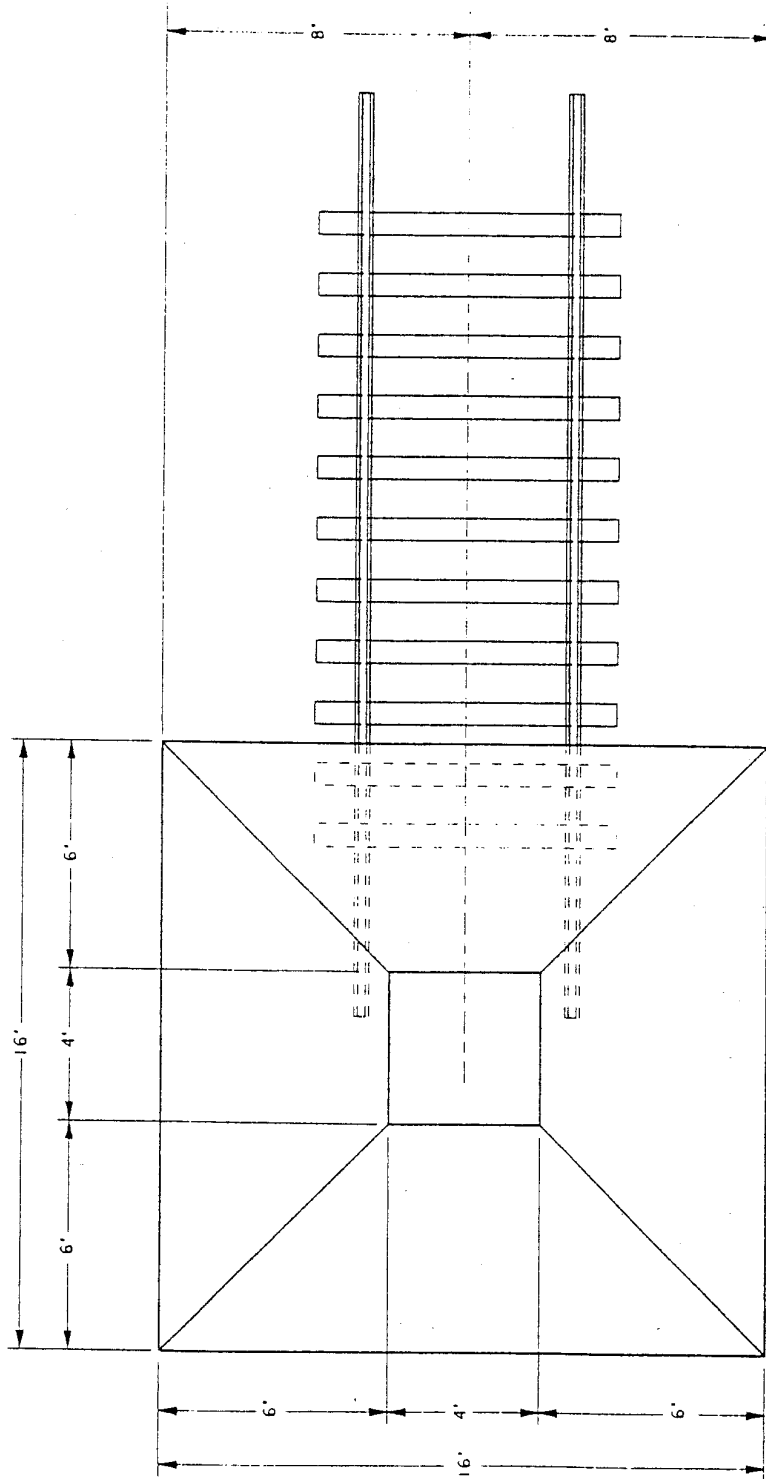
A-21

Project No. 243.19

Date 2/26/99

Approved By:

Figure



NOTES:
SIZE OF BASE MAY BE REDUCED IN CASES WHERE
WIDTH OF ROAD BED WILL NOT PERMIT PLAN TO BE
FOLLOWED.

EARTH BUMPER AS SHOWN HERE ON SHALL BE USED AT ALL LOCATIONS WHERE BUMPER IS REQUIRED, EXCEPT ON AUTHORITY OF THE CHIEF ENGINEER OF MAINTENANCE TO USE A BUMPER OF SOME OTHER DESIGN.

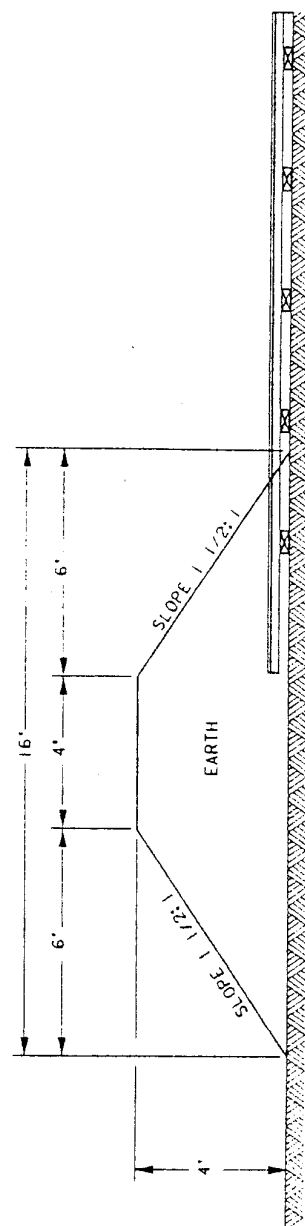
UNION PACIFIC RAILROAD
ENGINEERING STANDARDS

STANDARD EARTH BUMPER
FOR END OF SPUR TRACK

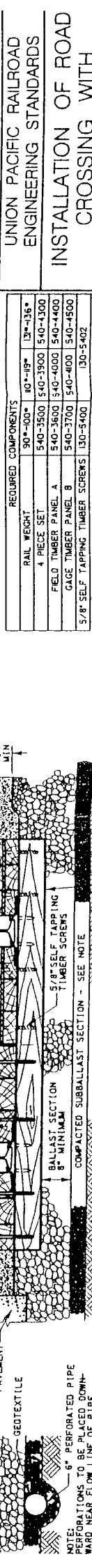
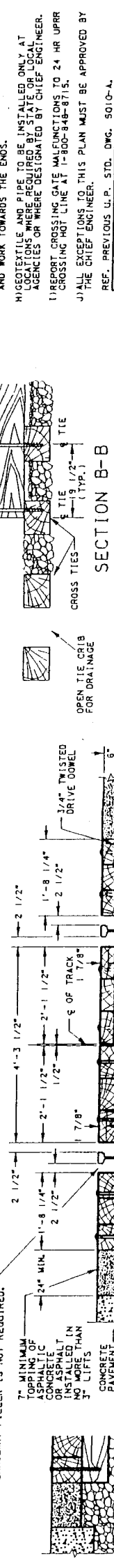
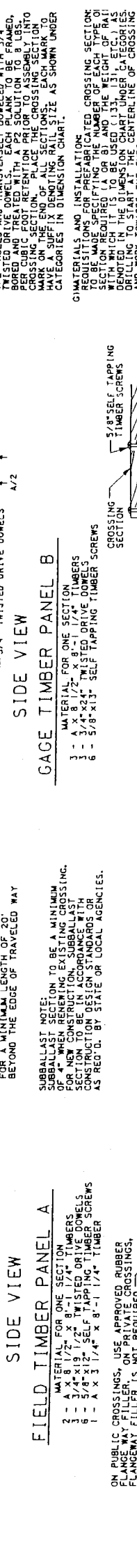
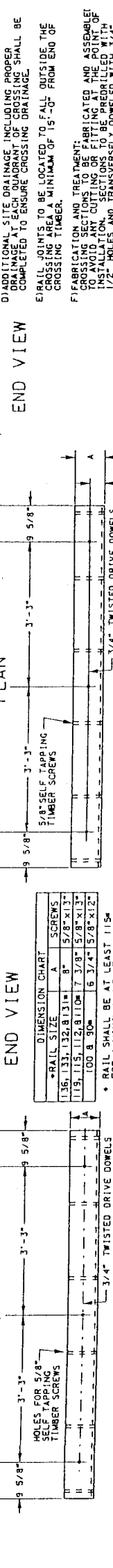
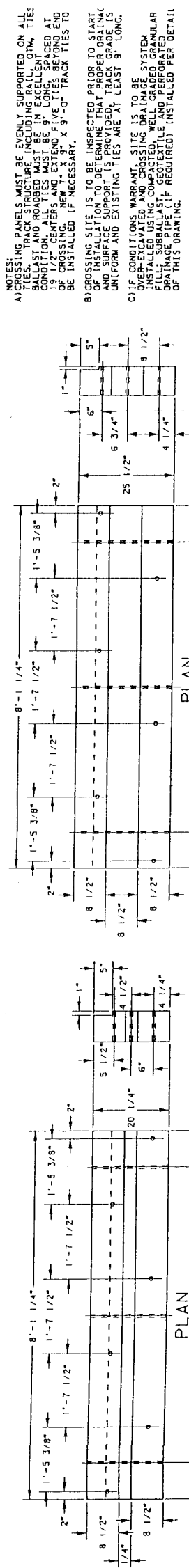
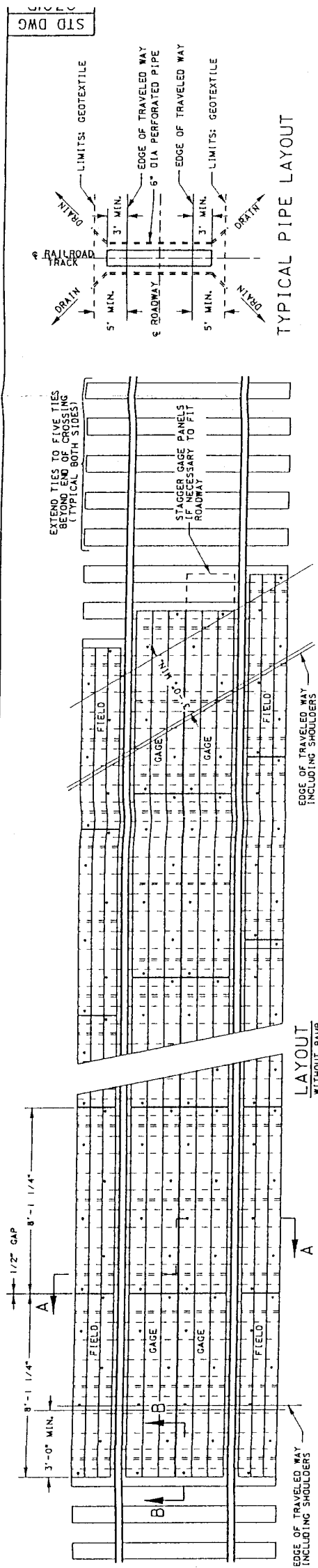
ADOPTED: FEB. 16, 1965
REVISED: DEC. 30, 1996
FILE NO.: 0030

STD DWG

0030



STD DWG
0030

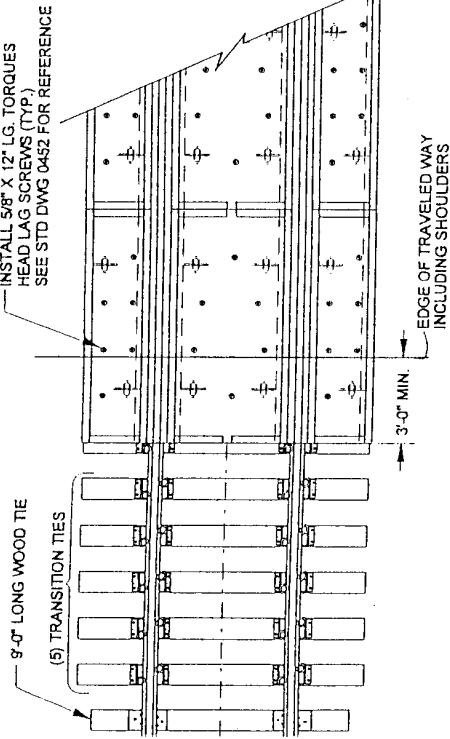


NOTES:
A) CROSSING PANELS MUST BE EVENLY SUPPORTED ON ALL TIES. TRACK STRUCTURE INCLUDING RAIL, OTM, TIES, BALLAST AND ROADBED MUST BE IN EXCELLENT CONDITION. TIES MUST BE 9' LONG, SPACED AT 15\"/>

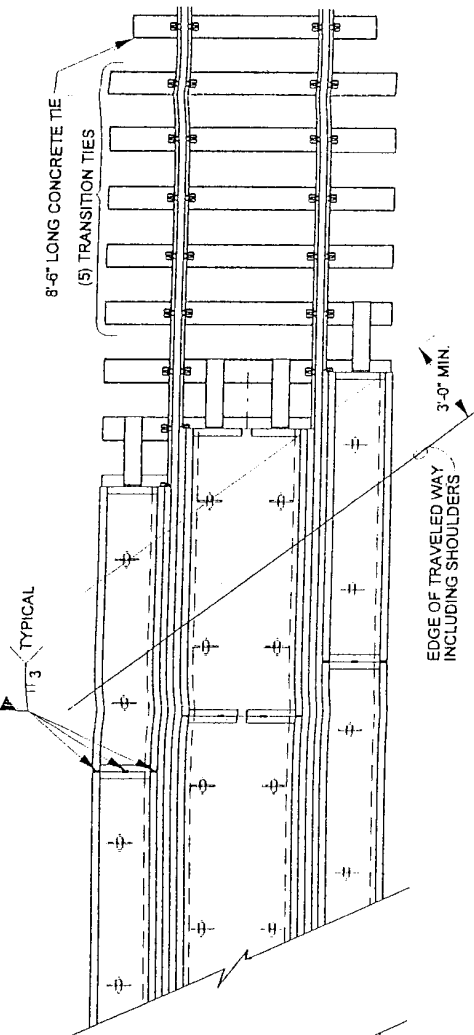
B) CROSSING SITE IS TO BE INSPECTED PRIOR TO START OF INSTALLATION TO DETERMINE THAT THE TRACK AND SURFACE SUPPORT IS PROVIDED. TRACK GRADE IS UNIFORM AND EXISTING TIES ARE AT LEAST 9' LONG.
C) IF CONDITIONS WARRANT, SITE IS TO BE OVER-EXCAVATED AND CROSSING DRAIN IS TO BE INSTALLED USING COMPACTED, WELL GRADED GRANULAR FILL. SUBBALLAST, GEOTEXTILE AND PERFORATED DRAINAGE PIPE (IF REQUIRED) INSTALLED PER DETAIL OF THIS DRAWING.
D) ADDITIONAL SITE DRAINAGE INCLUDING PROPER DRAINAGE AT EACH QUADRANT OF CROSSING SHALL BE COMPLETED TO ENSURE CROSSING DRAINAGE.
E) RAIL JOINTS TO BE LOCATED TO FALL OUTSIDE THE CROSSING AREA A MINIMUM OF 15'-0\"/>

F) FABRICATION AND TREATMENT:
CROSSING SECTIONS TO BE FABRICATED AND ASSEMBLED TO AVOID ANY CUTTING OR FITTING AT THE POINT OF INSTALLATION. SECTIONS TO BE PREDRILLED WITH 1/2\"/>

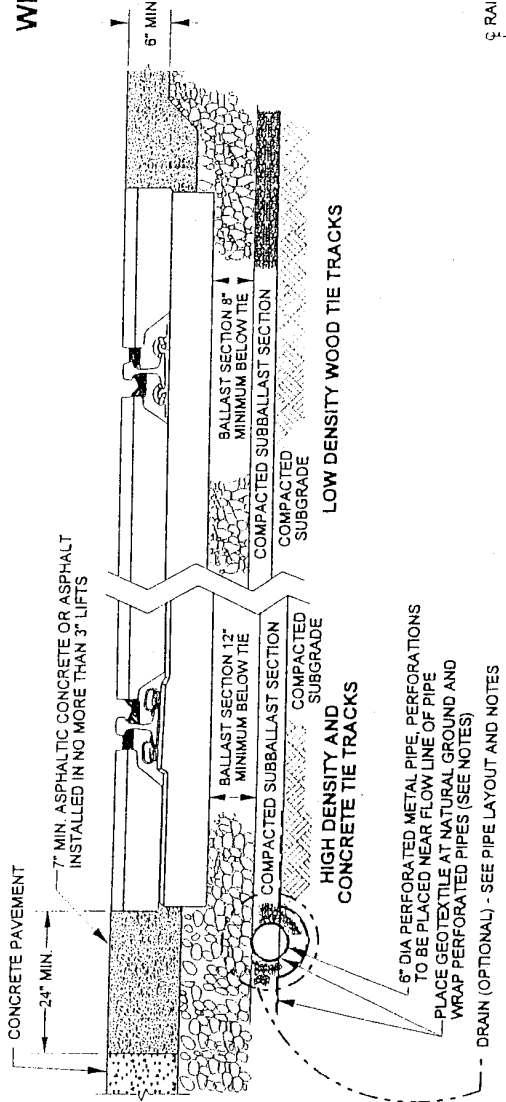
G) MATERIALS AND INSTALLATION:
REQUIREMENTS FOR PREPARED CROSSING SECTIONS TO BE MADE SPECIFYING THE NUMBER OF EACH TYPE OF SECTION REQUIRED (A OR B) AND THE WEIGHT OF RAIL DEMONSTRATION TIES TO BE USED (133, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 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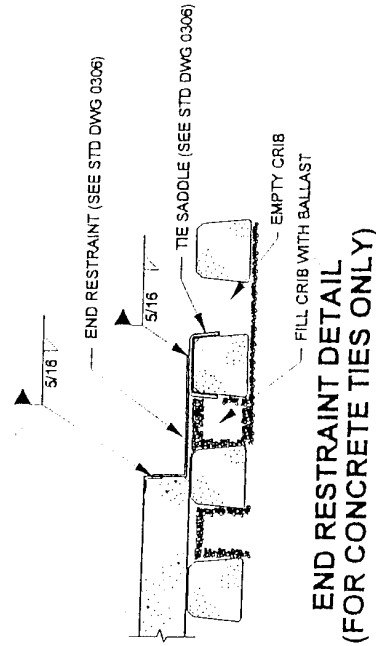
PLAN VIEW OF PANEL WITH TIMBER TIES



PLAN VIEW OF PANEL & JOINT
WELD LOCATION W/CONCRETE TIES



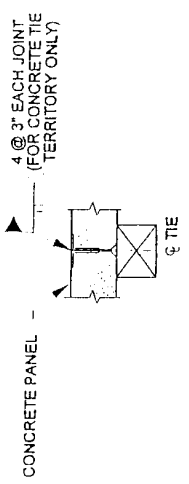
TYPICAL BALLAST AND ASPHALT DETAIL



END RESTRAINT DETAIL
(FOR CONCRETE TIES ONLY)

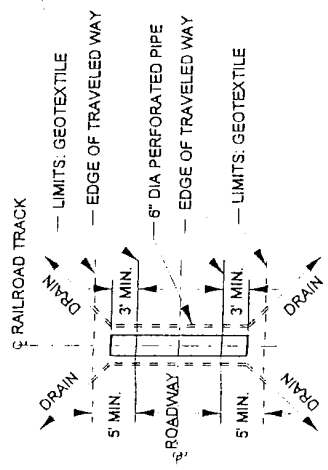
JOINT BETWEEN PANELS

INTERIOR JOINTS BETWEEN PANELS MUST REST ON CENTER LINE OF A WOOD OR CONCRETE TIE AS SHOWN



REQUIRED COMPONENTS	
RING LIFTING DEVICE	410-1371
5/8" TORQUES SCREW FOR WOOD TIES (STD DWG 0452)	130-5400
ELASTOMERIC BEARING PAD FOR 141 LB. RAIL ON WOOD TIES	540-0203
CONFORMAL ELASTOMERIC BEARING PAD FOR 10'-3" CONCRETE TIES	503-6315
CONFORMAL ELASTOMERIC BEARING PAD FOR 8'-6" CONCRETE TIES	503-6312
END RESTRAINT FOR CONCRETE TIES (ONLY)	540-1925

OPTIONAL COMPONENTS (SET INCLUDES 8 PIECES)	
20' SECTION 5" PERFORATED PIPE	510-3201
5" ADJUSTABLE ELBOW	510-3557
5" PIPE BANDS	510-3379
100' ROLL GEOTEXTILE	550-0119



TYPICAL PIPE LAYOUT

NOTE:
GEOTEXTILE & PIPE TO BE INSTALLED ONLY AT LOCATIONS WHERE REQUIRED BY STATE OR LOCAL AGENCIES OR WHERE DESIGNATED BY CHIEF ENGINEER.

NOTES:
CROSSING PANEL SUPPORT THROUGH THE CROSSING MUST BE UNIFORM. CONCRETE TIE SPACING IS TO BE A MAXIMUM OF 24" CENTER TO CENTER. WOOD TIE SPACING TO BE MAXIMUM OF 19 1/2" CENTER TO CENTER. TIE SPACING MUST BE ADJUSTED TO SUPPORT THE ENDS OF THE PANELS.

CROSSING SITE IS TO BE INSPECTED PRIOR TO START OF INSTALLATION TO DETERMINE THAT PROPER DRAINAGE AND SURFACE SUPPORT IS PROVIDED. TRACK GRADE IS UNIFORM AND EXISTING TIES ARE AT LEAST 10' LONG.

IF CONDITIONS WARRANT, SITE IS TO BE OVER-EXCAVATED AND CROSSING DRAINAGE SYSTEM INSTALLED USING COMPACTED, WELL GRADED GRANULAR FILL, SUBBALLAST, GEOTEXTILE AND PERFORATED DRAINAGE PIPE (IF REQUIRED) INSTALLED PER DETAILS OF THIS DRAWING.

ADDITIONAL SITE DRAINAGE INCLUDING PROPER DRAINAGE AT EACH QUADRANT OF CROSSING SHALL BE COMPLETED TO ENSURE CROSSING DRAINAGE.

PRECAST PANELS ARE TO BE HANDLED AND SUPPORTED AT SPECIFIED LIFTING INSERT LOCATIONS ONLY. LIFTING EQUIPMENT AND CONNECTION INSERTS ARE TO BE PROPERLY SIZED TO HANDLE THE LENGTH OF PANELS BEING INSTALLED. RING LIFTING DEVICES ARE AVAILABLE FROM COMPANY WAREHOUSE.

APPROACH ASPHALT ROADWAY PAVING IS TO MEET STATE DOT HIGHWAY SPECIFICATIONS AND IS TO BE INSTALLED ACCORDINGLY. ASPHALT IS TO BE INSTALLED WITH PAVEMENT WITH MAXIMUM 3" LIFTS AND LAID PARALLEL TO CROSSING TO MINIMIZE APPROACH SETTLEMENTS.

GEOTEXTILE AND PIPE TO BE INSTALLED ONLY AT LOCATIONS WHERE REQUIRED BY STATE OR LOCAL AGENCIES OR WHERE DESIGNATED BY CHIEF ENGINEER.

GALVANIZED ELASTIC FASTENERS ARE TO BE USED WITHIN THE CROSSING AREA AND ON THE (5) TRANSITION TIES ON EACH SIDE OF THE CROSSING. PANDROL E-CLIPS TO BE USED ON WOOD TIE CROSSINGS AND SAFELOK CLIPS ON CONCRETE TIE CROSSINGS.

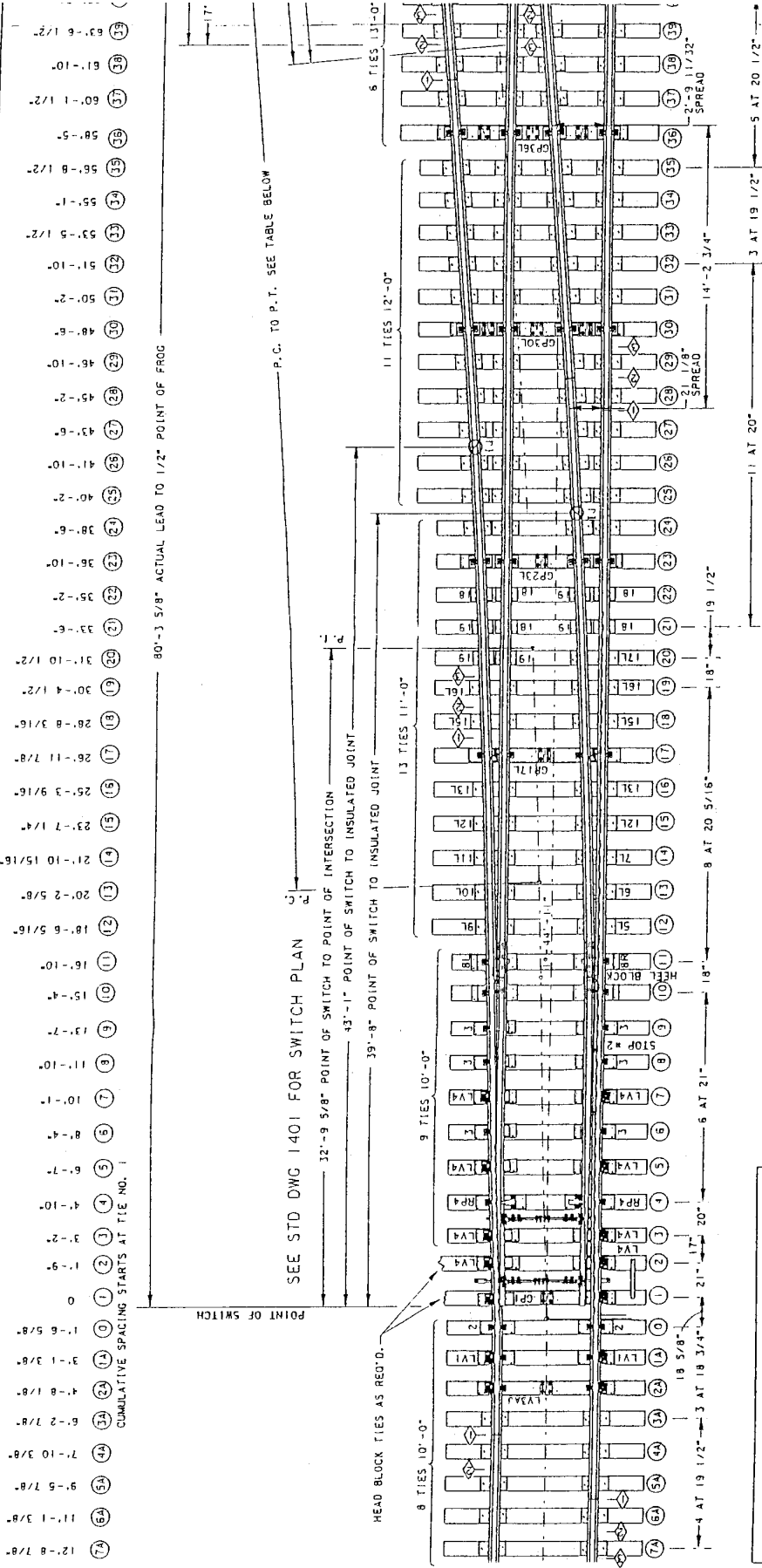
ALL RAIL JOINTS IN CROSSING AREA TO BE WELDED. DO NOT INSTALL BOLTED JOINT BARS.

REPORT CROSSING GATE MALFUNCTIONS TO 24 HR UPRR CROSSING HOT LINE AT 1-800-848-8715.

ALL EXCEPTIONS TO THIS PLAN MUST BE APPROVED BY THE CHIEF ENGINEER.

UNION PACIFIC RAILROAD
ENGINEERING STANDARDS

INSTALLATION OF ROAD
CROSSINGS WITH PRECAST
CONCRETE PANELS

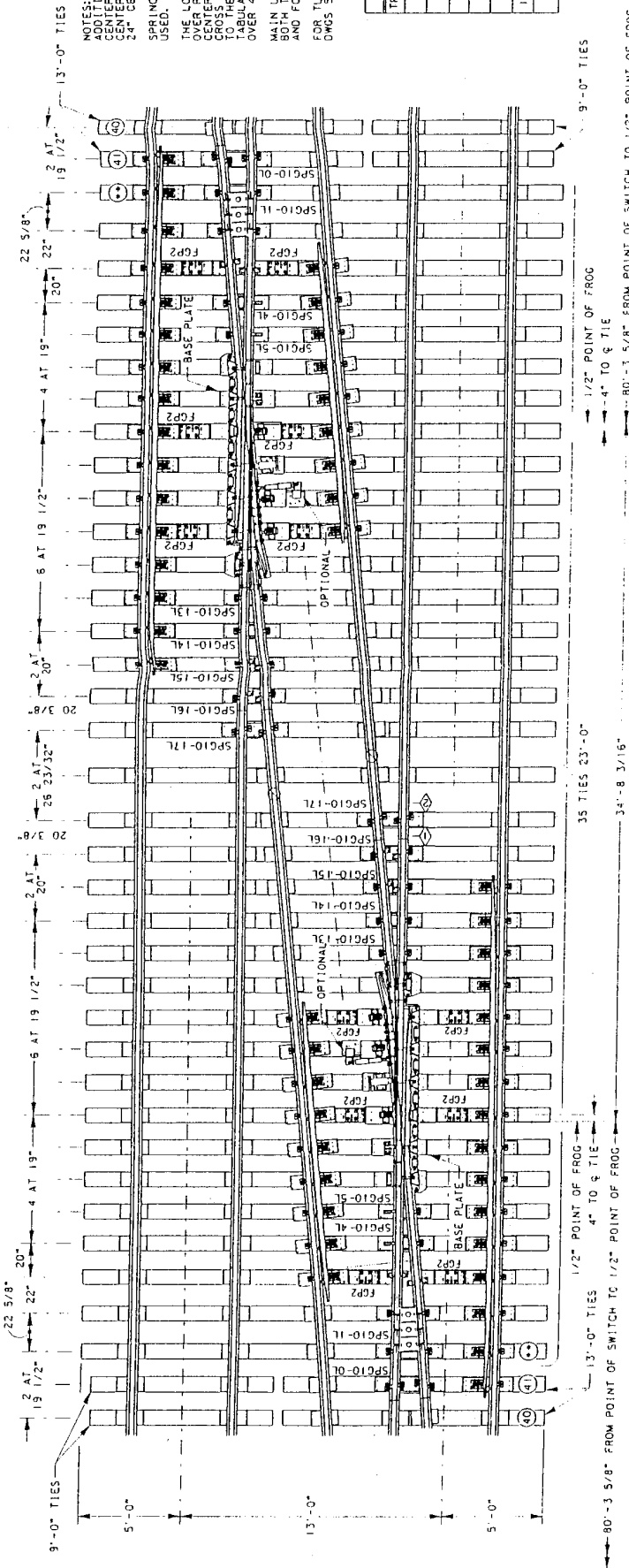


LH TURNOUT SHOW

THEORETICAL TURNOUT DESIGN DATA TABLE AS FURNISHED	
NUMBER	10
FROG	ANGLE
	5°-43'-29"
	TOE LENGTH
	13'-10"
16'-6" SWITCH	HEEL LENGTH
	14'-2"
	TOTAL LENGTH
	28'-0"
16'-6" SWITCH	LENGTH OF SWITCH (POINTS)
	18'-6"
	HEEL SPREAD
	6 1/4"
16'-6" SWITCH	STRAIGHT STOCK RAIL
	54'-7"
	BENT STOCK RAIL
	38'-3"
16'-6" SWITCH	HEEL ANGLE
	1°-44'-11"
	THICKNESS AT POINT
	1/4"
16'-6" SWITCH	ANGLE AT POINT
	1°-44'-11"
	RADIUS (CLOSURE CURVE)
	752.66+1324'
16'-6" SWITCH	VERTICE DISTANCE
	8 1/4"
	THICKNESS AT POINT
	1/4"
16'-6" SWITCH	ANGLE AT POINT
	1°-44'-11"
	RADIUS (CLOSURE CURVE)
	NONE
16'-6" SWITCH	VERTICE DISTANCE
	8 1/4"
	ACTUAL LEAD
	80'-3 5/8"
16'-6" SWITCH	RADIUS OF CENTERLINE
	749.753945694'
	T =
	26'-1 1/2"
TURNOUT	CENTRAL ANGLE - CLOSURE CURVE
	3°-59'-18"
TURNOUT	DEGREE OF CURVE
	7°-38'-31"

TURNOUT BILL OF MATERIAL	
QTY.	DESCRIPTION
140	16" TIE PLATES
840	SPIKES
1	16'-6" L.H. SWITCH POINT (NON-EXTENDED)
1	16'-6" R.H. SWITCH POINT (NON-EXTENDED)
**1	34'-8" L.H. SPRING FROG
*1	25'-0" FROG GUARD RAIL
*1	15'-0" FROG GUARD RAIL
1	58'-6" STRAIGHT STOCK RAIL
1	39'-6" BENT STOCK RAIL
2	39'-0" 1-BOND MITRE CUT
270 FT.	133 LB. H.H. RAIL
1	SWITCH PLATE PACKAGE
*1	FROG PLATE PACKAGE
*1	TURNOUT PLATE PACKAGE
6	FROG GAGE PLATES

* INCLUDES CLIPS AND COACH SCREWS
** 28'-0" SPRING FROG USED ON NEW INSTALLATION



NOTES:
1. OPTIONAL TIES REQUIRED FOR INCREASED TRACK CENTERS ARE TO BE EVENLY SPACED IN THE CENTER OF THE CROSSOVER WITH A MAXIMUM OF 24" CENTERS.
2. SPRING FROGS SHOWN. RBN FROGS MAY ALSO BE USED.
3. THE LOCATION OF THE INSULATED JOINTS ON CROSS-OVER TRACKS SHALL BE TO THE INSIDE OF THE TRACK CENTERS WHERE TRACK CENTERS ARE GREATER THAN 16'. WHERE TRACK CENTERS ARE GREATER THAN 16' CROSS OVER RAILS MUST BE EXTENDED ACCORDING TO THE CRITERIA SHOWN IN THE CROSS-OVER DATA TABLE. INSULATED JOINTS SHALL BE LOCATED OVER 4'-6" FROM THE TRACK CENTER.
4. MAIN LINE CROSS OVER INSTALLATIONS MUST HAVE BOTH TRACKS AT CROSS LEVEL WITH EACH OTHER AND FOR 1500 FEET IN ADVANCE OF EACH OTHER.
5. FOR TURNOUT AND ASSOCIATED DWGS, SEE STD DWGS 5020-1 AND 5025

CROSS-OVER DATA		
DISTANCE BETWEEN 1/2" FROG POINTS		
TRACK CENTERS	MAIN TRACK	CROSS-OVER
13'-0"	34'-8 3/16"	35'-3 15/16"
14'-0"	44'-7 7/8"	45'-3 5/8"
15'-0"	54'-7 9/16"	55'-3 5/16"
16'-0"	64'-7 1/4"	65'-3"
17'-0"	74'-6 15/16"	75'-2 11/16"
1" CHANGE	9.9752"	10'-0 5/16"
1" CHANGE	9.9752"	10.0252"

NOTE: FROGS, PLATES, AND GUARD RAILS MAY VARY

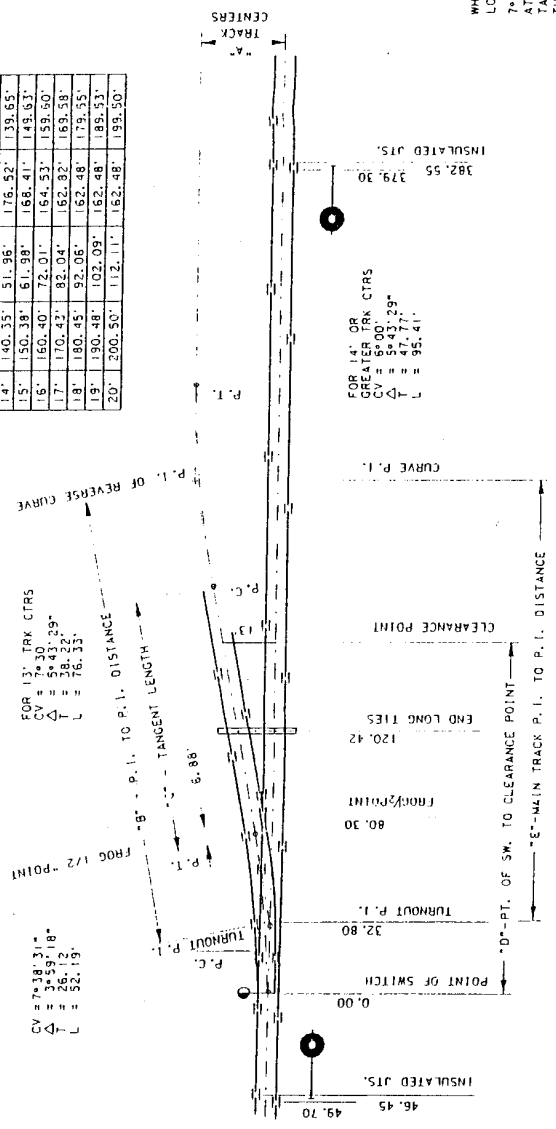
TABLE OF VARIABLE DIMENSIONS BASED ON TRACK CENTERS (A)					
A	B	C	D	E	F
13'	130.33'	51.48'	200.70'	129.68'	
14'	140.35'	51.36'	176.52'	139.65'	
15'	150.38'	61.98'	168.41'	149.63'	
16'	160.40'	72.01'	164.53'	159.60'	
17'	170.42'	82.04'	162.92'	169.58'	
18'	180.45'	92.06'	162.48'	179.55'	
19'	190.48'	102.09'	162.48'	189.53'	
20'	200.50'	112.11'	162.48'	199.50'	

BILL OF TIES		7" x 9" SWITCH TIES														TAPERED 8" TO 10" X 10"		TOTAL
NO.	LENGTH OF TIE	10'	11'	12'	13'	14'	15'	16'	17'	18'	23'	24'	25'	26'	27'	** 10'	14'-6"	
NO. 10 CROSS-OVER	HAND	34	26	22	16						35					42	2	133
WITH 13' TRK CTRS	POWER	32	26	22	12						35						4	133
NO. 10 CROSS-OVER	HAND	34	26	22	16	12					30					48	2	140
WITH 14' TRK CTRS	POWER	32	26	22	12	12					30						4	140
NO. 10 CROSS-OVER	HAND	34	26	22	16	12	12				24					54	2	146
WITH 15' TRK CTRS	POWER	32	26	22	12	12	12				24					19	2	146
NO. 10 CROSS-OVER	HAND	34	26	22	16	12	12	12			19					60	2	153
WITH 16' TRK CTRS	POWER	32	26	22	12	12	12	12			19					13	2	153
NO. 10 CROSS-OVER	HAND	34	26	22	16	12	12	12	16							66	2	163
WITH 17' TRK CTRS	POWER	32	26	22	12	12	12	12	16							13	2	163

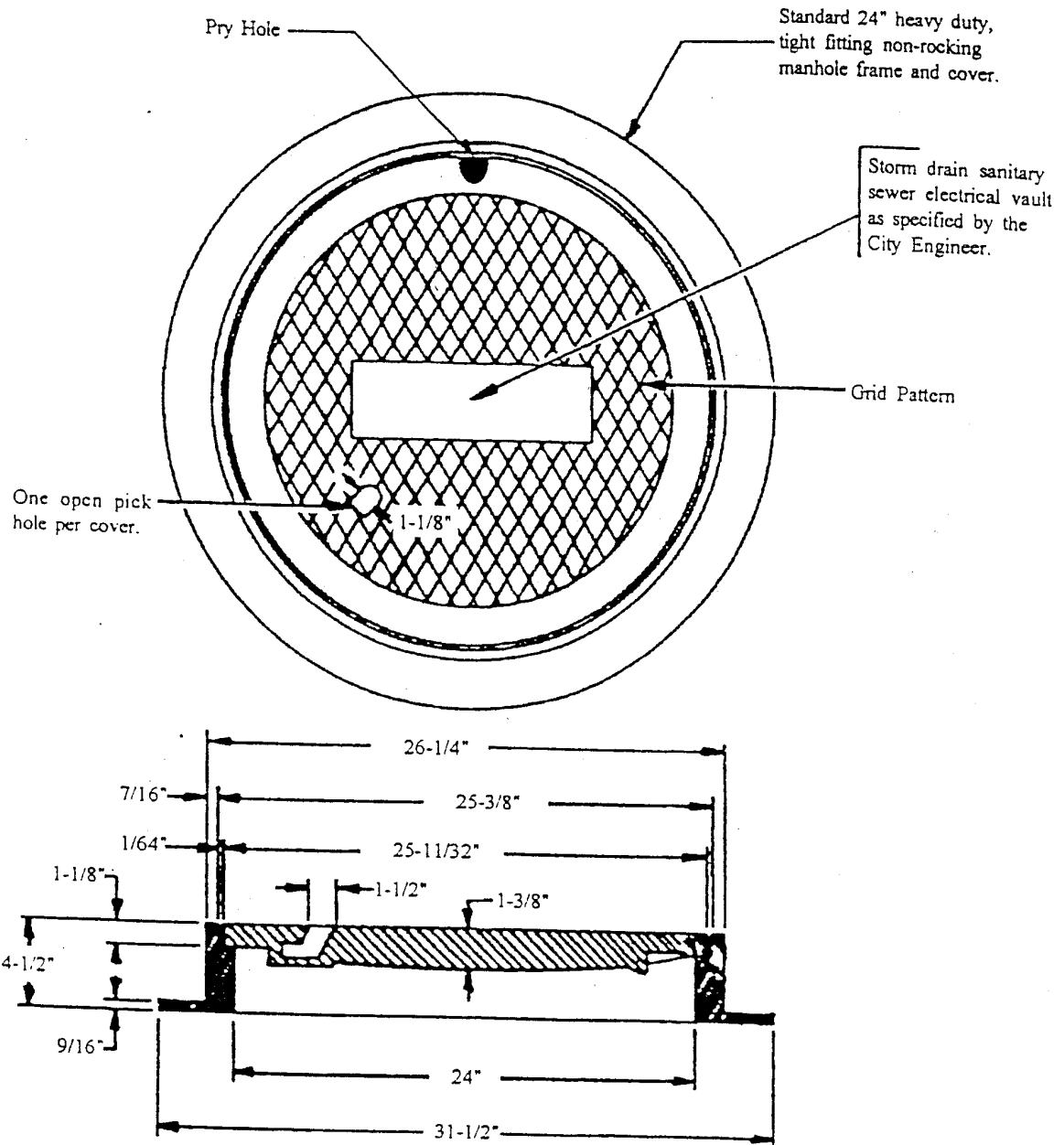
FOR CROSS-OVERS ON 17'-6" OR GREATER TRACK CENTERS, THE BILL OF SWITCH TIE MATERIAL IS BASED ON THE USE OF TWO COMPLETE TURNOUTS.
** TIE NO. AT WHICH LONG TIES 23' AND OVER START (SEE STD DWG 5020-1)

LEGEND
○ LH MITER CUT INSULATED JOINT
○ RH MITER CUT INSULATED JOINT

WHERE TRACK CENTERS ARE 20' OR GREATER, SIGNAL MAY BE LOCATED ON EITHER SIDE OF THE MAIN TRACK.
7'-30" OR 8'-00" CURVE TO HAVE 3/4" SUPERELEVATION WITH RUN OFF AT THE RATE OF 1" IN 44'-0" ON 13' TO 16' TRACK CENTERS. THE TANGENT LENGTH BETWEEN THE LAST LONG SWITCH TIE AND THE P.C. OF THE REVERSE CURVE IS INSUFFICIENT TO ACCOMMODATE THIS RUN-OFF RATE. FOR THESE TRACK CENTERS, SUPERELEVATION WILL BEGIN AT THE LAST LONG SWITCH TIE BEHIND THE FROG AND RUN INTO THE CURVE AT THE RATE OF 1" IN 44'-0" UNTIL THE FULL SPECIFIED SUPERELEVATION IS REACHED.



LAYOUT ARRANGEMENT FOR PARALLEL TRACKS WITH LEFT HAND SIGNALS



NOTES:

1. Specify Sanitary Sewer, Storm Drain, or Electrical Vault when ordering. All casting shall be dipped in approved Asphalt Paint.
2. All material used in manufacturing shall conform to A.S.T.M. designation A-159-G3000, or of United States Government Specifications QQ-652b.
3. Minimum Weight Components:

Cover	-	130 lbs.
Frame	-	135 lbs.


• APPROVED MANHOLE FRAME & COVER •

Phoenix Iron Works Cat. No. P-1090CPH

D & L Supply Cat. No. A-1024 CPH

South Bay Foundry Cat. No. SBF-1900CPH

Pinkerton Foundry Cat. No. A-640

CITY OF PETALUMA Department of Engineering 22 Bassett Street - Petaluma California 94952 707.778.4304 - Fax 707.778.4437 Approved By: <i>Thomas S. Hargis</i> Thomas S. Hargis - R.C.E. 22366	Standard Mainhole Frame and Cover Detail	Drawn By: Butch Smith Scale: N. T. S. Date: March 15th 1995 File Number: Std. Det. SSS0000.510
		 Page 510

FIRE HYDRANT PAINTING

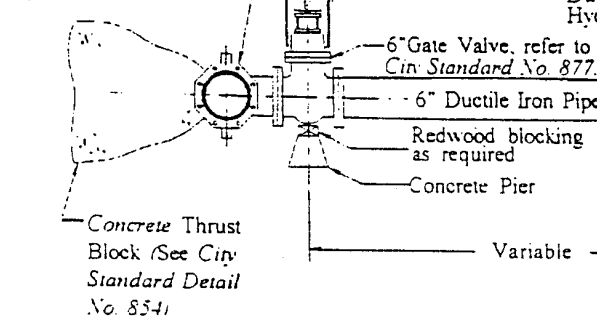
Fire hydrant painting shall conform to *AWWA Standard Specification C503*. The finished paint color shall be *Yellow*. All damaged paint surfaces shall be corrected by touch up prior to acceptance.

NOTE:

1. Where no sidewalk exists, or where Hydrant is installed in planter strip, a 6" thick *Concrete Pad* shall be installed as shown in the typical plan view below.
2. *Residential* Fire Hydrants will have two 2-1/2" & one 4-1/2" outlet. *Commercial* Fire Hydrants will have one 2-1/2" & two 4-1/2" outlet.
3. Verify Fire Protection Requirements with the *City Fire Department*.
4. See *City Standard No. 850* for Water System Design and Construction Guidelines.
5. Install min of 10'-0" from Driveway.

Valve Box & Riser Refer to
City Standard Detail
No. 877.

Tapping Sleeve or
Hydrant Tee



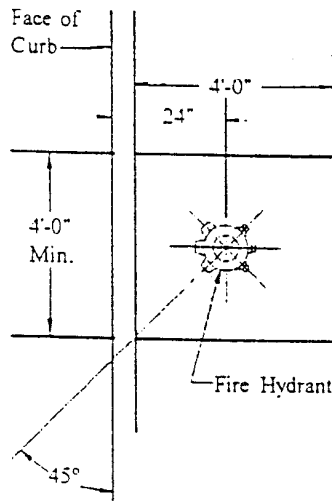
6" Break-off Riser. Set
so that break-off line is
at or above finish grade.
To be installed with
Break-off Bolts

Concrete Sidewalk Pad
(See Note 1)

Concrete Block to extend
to undisturbed ground.

Hydrant Riser - Length as
required.

Concrete Thrust Block to
extend to undisturbed
ground. See *City Standard*
Detail No. 854



PLAN VIEW
Mid-Block Location

On Commercial
Hydrants, face 4-1/2"
outlet to Street

Curb Return

Face of Curb

PLAN VIEW
Typical Curb Return

CITY OF PETALUMA
Department of Engineering

22 Bassett Street - Petaluma California 94952
707.764.3041 - Fax 707.764.437

Approved By:

Thomas S. Hargis
Thomas S. Hargis - R.C.E. 22366

Typical FIRE HYDRANT INSTALLATION

Drawn By:
Butch Smith

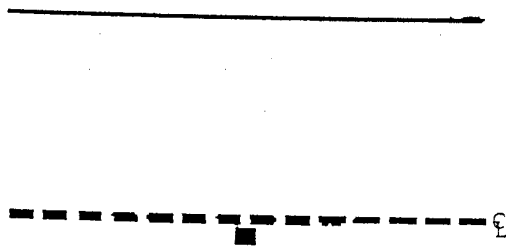
Scale:
N. T. S.

Date:
April 13th 1998 (Rev.)

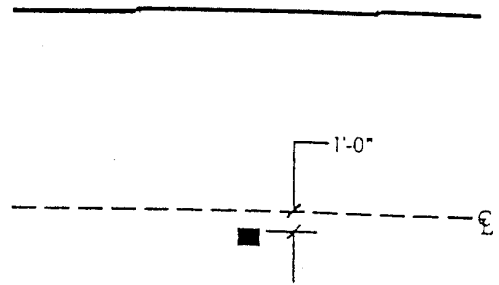
File Number:
Std. Det. WSD0000.857.01



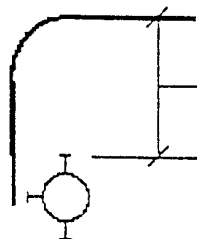
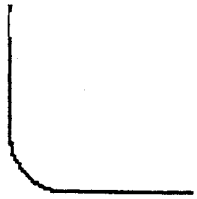
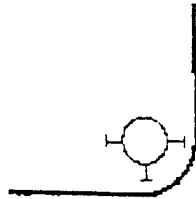
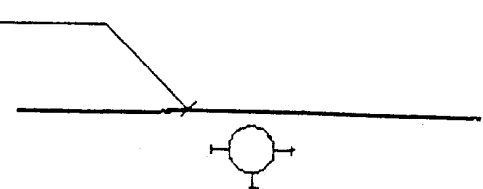
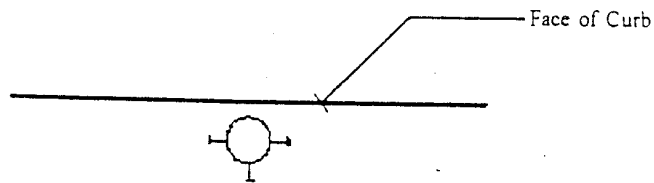
Page
857.01



When Street has existing centerline pavement marking, *Hydrant Marker* will be located beside Centerline on side closest to Hydrant.



When Street is without centerline pavement marking, *Hydrant Marker* will be located one foot off center of street towards Hydrant.



When distance between curb and hydrant is twenty feet or greater, *Hydrant Marker* is needed only at point "A". If distance is less than twenty feet, *Hydrant Marker* is needed at points "A" and "B".

CITY OF PETALUMA
 Department of Engineering
 11 English Street • Petaluma California 94952
 Tel: 707.768.4301 • Fax: 707.768.4498
 Approved By:
Thomas S. Hargis
 Thomas S. Hargis - R.C.E. 22566

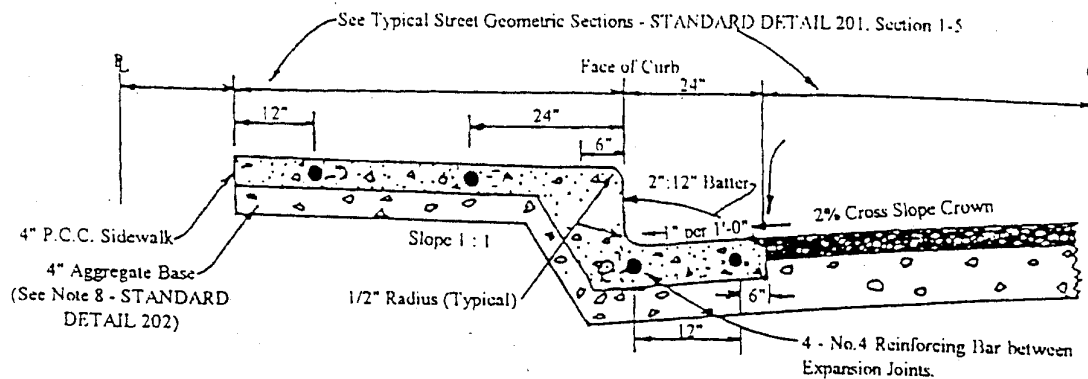
**Standard
 Fire Hydrant
 Marker
 Detail**

Drawn By:
 Butch Smith
 Scale:
 N. T. S.
 Date:
 April 13th 1998 (Rev.)
 File Number:
 Std. Det. WSD0000.857.02

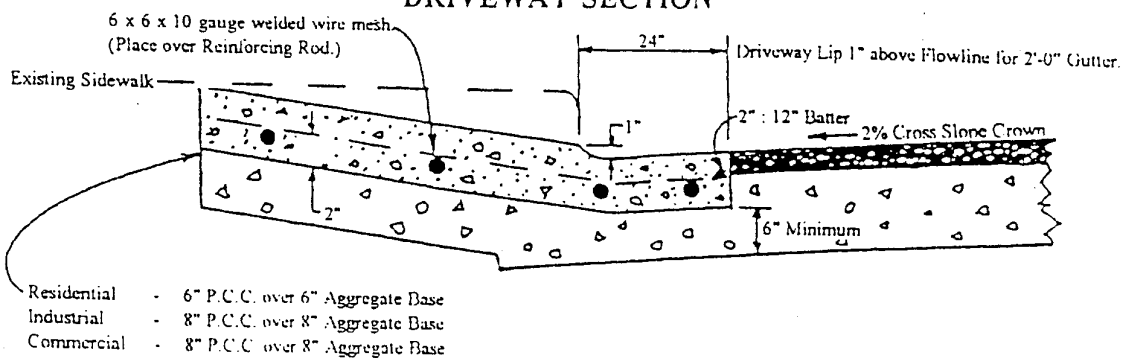


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 857.02

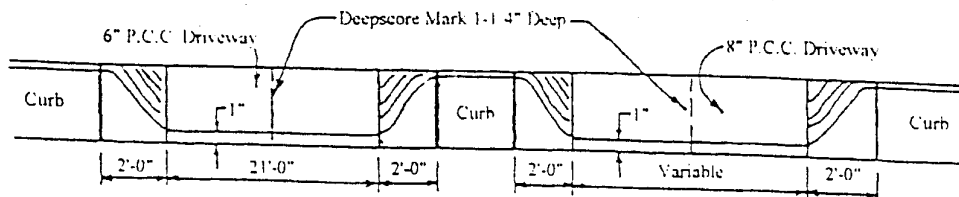
SIDEWALK SECTION



DRIVEWAY SECTION



RESIDENTIAL DRIVEWAY



1/4" Expansion Joint each end of Driveway
(See STANDARD DETAIL 202 Note 5)

COMMERCIAL DRIVEWAY

CITY OF PETALUMA
Department of Engineering
22 Bacon Street - Petaluma California 94952
707 778 4304 - Fax 707 778 4437

Approved By
Thomas S. Harris
Thomas S. Harris - R.C.P. 2236

Standard Details
**CURB, GUTTER
SIDEWALK
DRIVEWAY**
X-Section

Drawn By
Butch Smith

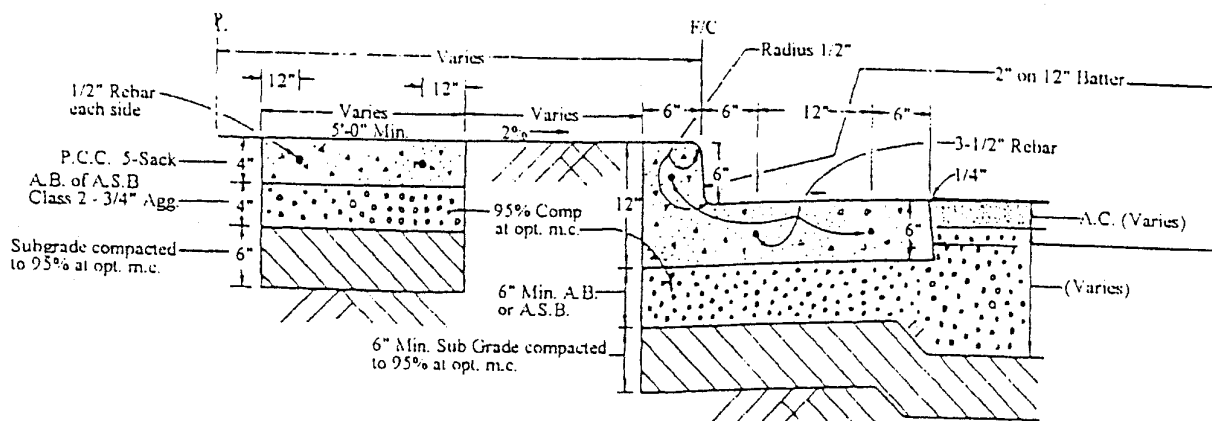
Scale
N T S

Date
February 9th 1997 (Rev.)

File Number
S.D.D. 220000 203 1-10-97

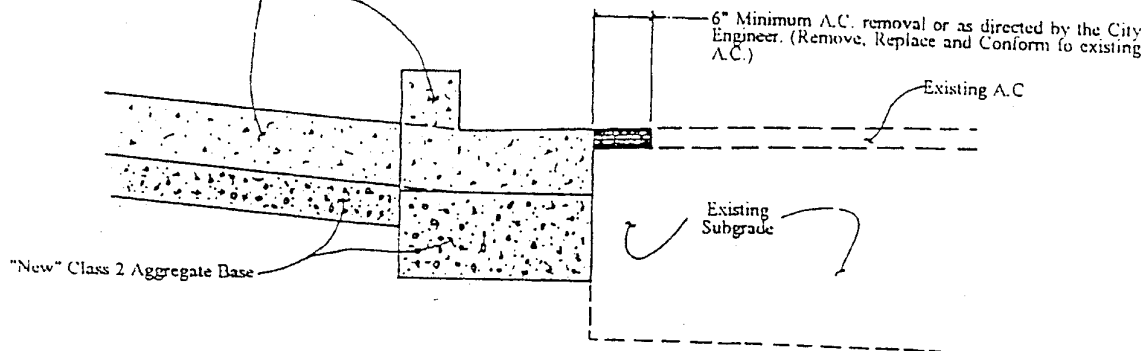


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203



**SIDEWALK, CURB AND GUTTER SECTION
WITH PLANTER STRIP "NEW"**

"New" curb and gutter and or
driveway approach as per City
Standard Detail.



**STREET CONFORM DETAIL
AT NEW CURB AND GUTTER OR DRIVEWAYS**

NOTES:

LANDSCAPED AREAS

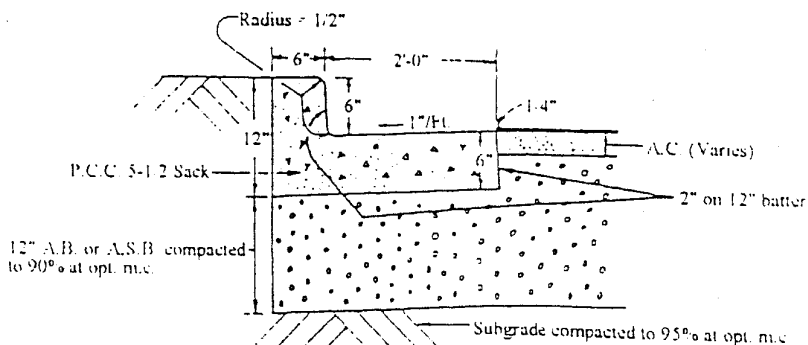
Try to save all plants, plants damaged or
removed by the contractor shall be replaced
"in Kind" at the contractor's expense.

For additional details, See 1984 CALTRANS
Standard Plans, Page 85 and 86, drawings
N8B and N8C.

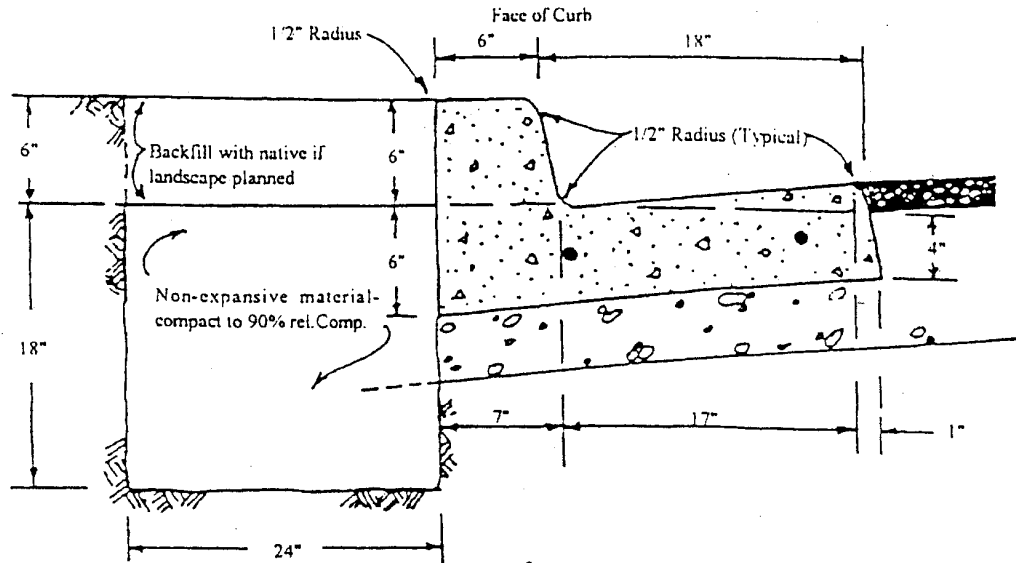
1. Expansion joints are required at 60'-0"
intervals with 3 each 1/2" diameter Rebar
Dowels.
2. Scarify all subgrade and compact to 95%
at opt. m.c.
3. Compact A.S.B. or A.B. to 95% at
optimum moisture content.
4. Refer to Sidewalk Section.

For expansive soils See City Standard Detail
Specification No. 41 paragraph 4102.2 relative
compaction.

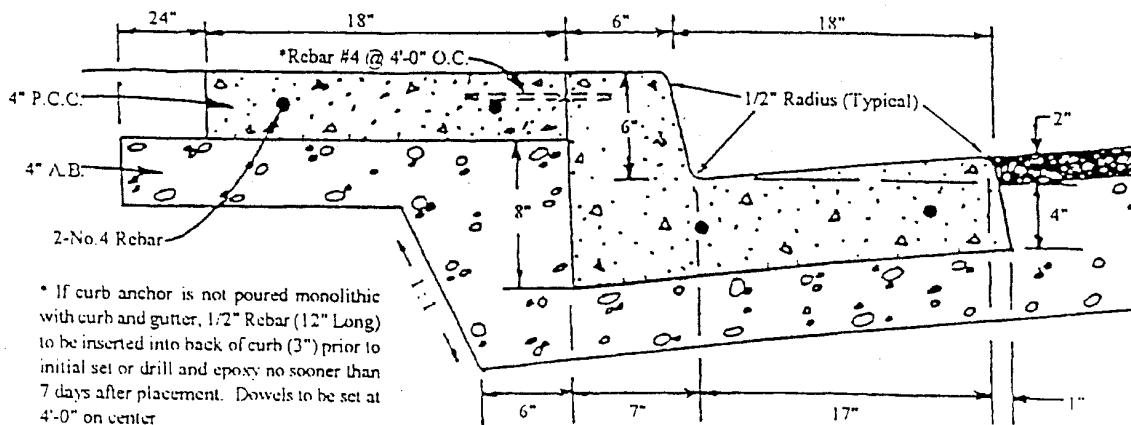
Contractor must remove a minimum of 6" of
A.C. or more at the discretion of the Director
of Engineering to form for curb and gutter or
Driveway approach.



P.C.C. PLACEMENT BY EXTRUSION MACHINE



STANDARD CURB AND GUTTER
with Non-expansive Backing



STANDARD CURB AND GUTTER
with Curb Anchor

NOTE:

1. Curb and gutter with non-expansive backing or with curb anchor are optional or as directed by the Engineer.
2. Placement of Curb Anchor shall conform to STANDARD DETAIL 203 and DETAIL SPECIFICATION 41, Section 202.8.
3. If non-expansive material is to be used, the Engineer may require testing by an accredited soils lab prior to placement. Sand or pea gravel will not be allowed

CITY OF PETALUMA
Department of Engineering
22 Bassen Street - Petaluma, California 94952
707 776 4304 - Fax 707 776 4177

Approved By: *Thomas S. Hargis*
Thomas S. Hargis R.C.E.

Standard Details

STANDARD
CURB & GUTTER

Drawn By: *Butch Smith*
Scale:

N.T.S.

Date:

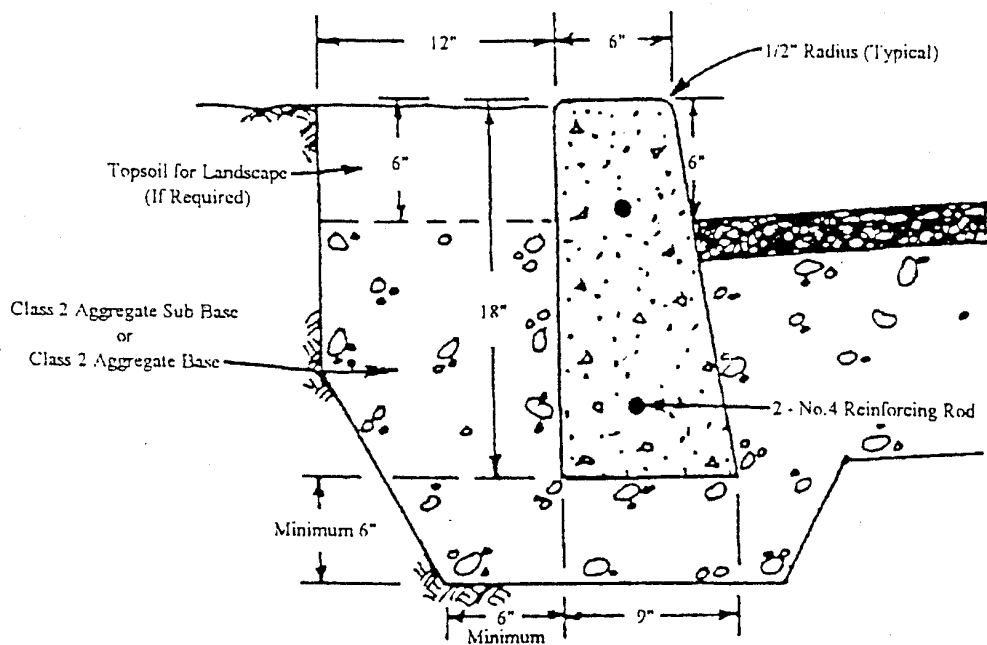
February 9th 1998 (Rev)

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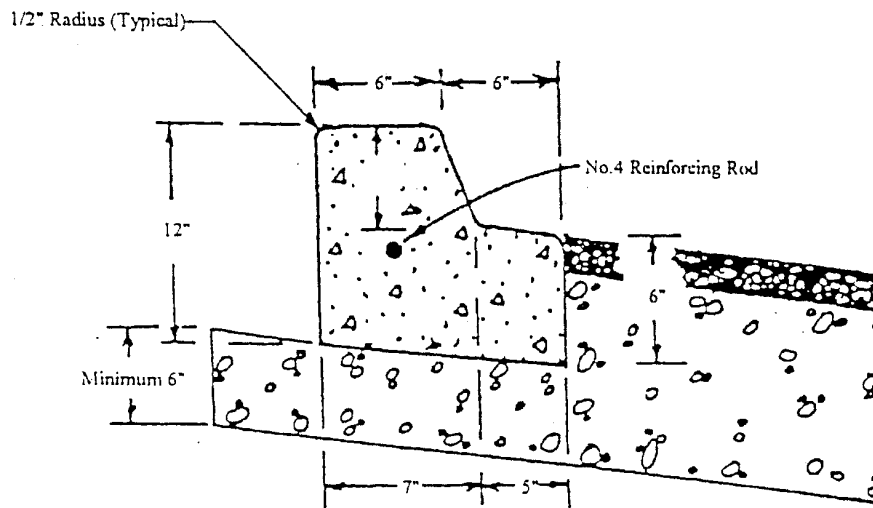
Std Det SSD0000 204 1 of 2



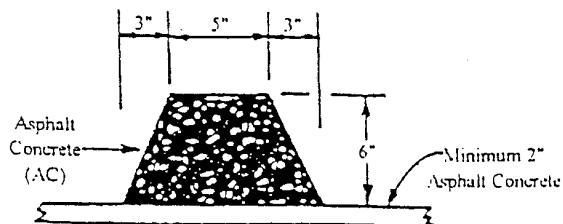
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VERTICAL CURB



CURB AND FALL AWAY GUTTER



ASPHALT CONCRETE CURB

NOTE:

Asphalt concrete curb to be placed by an acceptable extrusion machine only.

CITY OF PETALUMA
Department of Engineering

22 Cassett Street - Petaluma California 94952
707 778 4304 - Fax 707 778 4437

Approved By

Thomas S. Hargis
Thomas S. Hargis R.C.E. 22766

Standard Details
CURB
&
GUTTER

Drawn By
Butch Smith

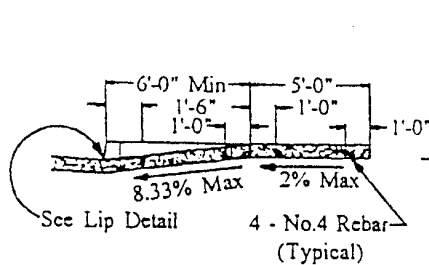
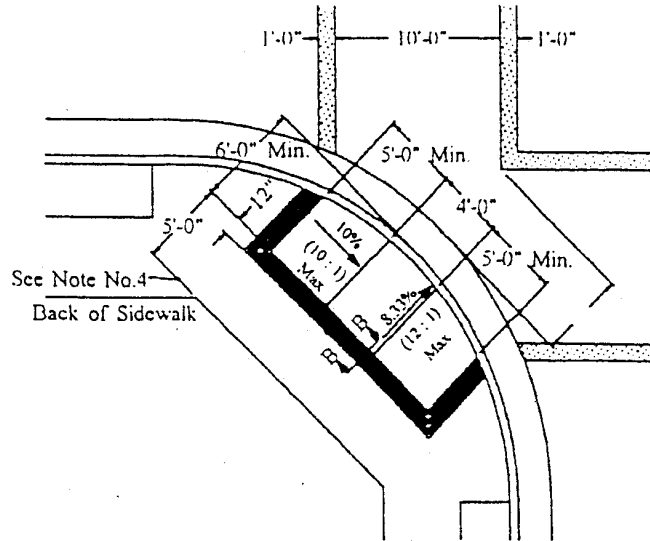
Scale
N.T.S.

Date
September 4th 1996

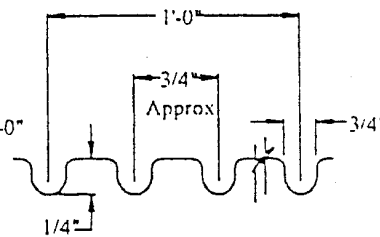
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Std Det SSS0000 204 2 of 2



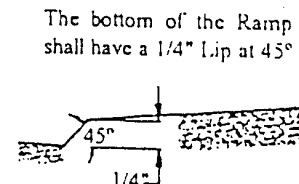
Page
204



RAMP DETAIL



SECTION B - B



LIP DETAIL

NOTE:

1. Design shall conform to these requirements except as otherwise approved by the Director of Engineering.
2. For subdivisions where sidewalks are not required for street improvement, curb depressions for curb ramps shall be omitted.
3. The surface of each curb ramp shall be slip resistant and shall be of contrasting finish for that of the adjacent sidewalk.
4. Type "B" or "C" ramp to be used in situations when 5'-0" minimum landing can not be obtained.
5. Sidewalk and ramp thickness shall be 4" of P.C.C. with four No 4 rebar continuous over 4" of Class 2 A.B. compacted to 95%.
6. If curb exists, 12" dowels are required at 4'-0" on center between existing curb and new construction.

CITY OF PETALUMA
Department of Engineering
27 Bassett Street - Petaluma California 94952
707-778-4204 - Fax 707-778-4437

Approved By
Thomas S. Hargis
Thomas S. Hargis - R.C.E. 22366

Standard
CURB RAMP
TYPE - A
Detail

Drawn By
Butch Smith
Scale
N T S
Date
February 9th 1998 (Rev.)
File Number
Std. Det. SSD0000.206 1 of 3



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206

Standard Street Sign to be located edge of Sidewalk.

Insert Sign Tu

24"

18"

8"

30"

8"

Diagram illustrating the standard street sign installation. The sign is mounted on a post, and the dimensions are specified: 24" for the height of the sign, 18" for the height of the post, 8" for the width of the sign, and 30" for the height of the post. The sign is located at the edge of the sidewalk. The diagram also shows the sign being inserted into the post.

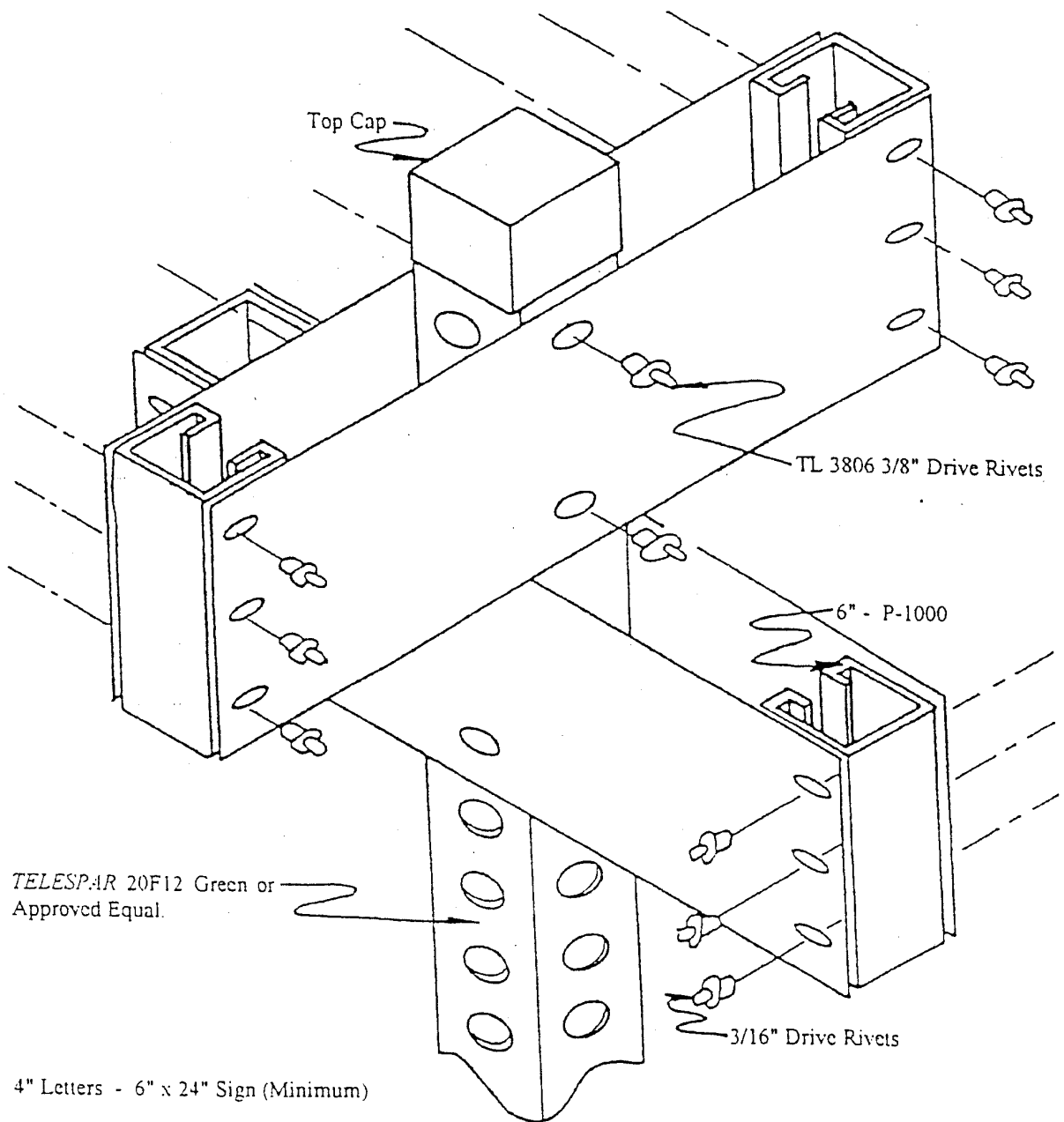
Use a Standard 30" STOP Sign with 8" Minimum letters
Use "SCOTCHLITE" reflective State Hwy. Sign R1

A technical diagram of a stop sign assembly. At the top is a rectangular sign with the text "MAIN ST.". Below it is an octagonal stop sign with the word "STOP" in large, bold, sans-serif capital letters. The sign is mounted on a vertical post. A dimension line on the left indicates a distance of "7' - 0\" from the top of the post to the center of the stop sign. Another dimension line indicates a distance of "18\" from the center of the stop sign to the top of a concrete base. The post is shown passing through the concrete base, which is labeled "Cold Joint". The post has a series of small circles along its length, possibly representing bolts or a textured surface. The concrete base is shown with a cross-section, revealing aggregate and a rebar.

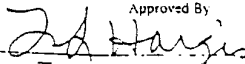

Approved By
Ed Hargin

Trans By
Butch Smith
Scale
N T S
Date
September 4th 1996
File Number
34138 SSS0000205

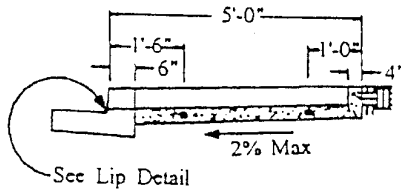
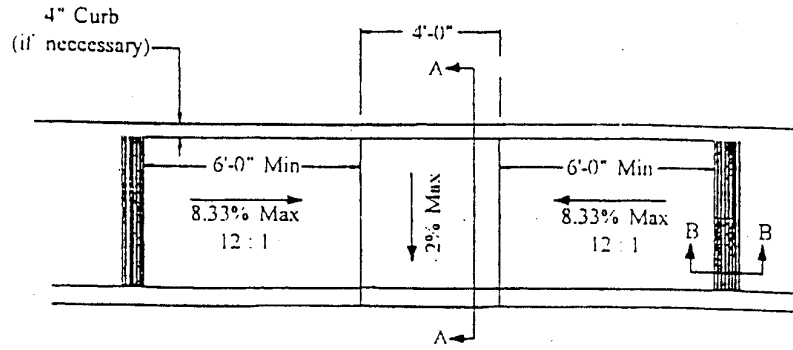




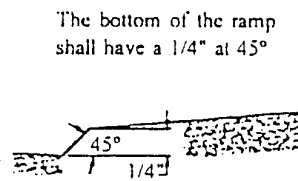
All Signs shall be *SCOTCHLITE* Reflective or equal mounted on Aluminum, Minimum thickness 0.080" Letters shall be Silver mounted on Green back-ground

<p>CITY OF PETALUMA Department of Engineering 22 Bassett Street - Petaluma, California 94952 707 778-1504 - Fax 707 778-4157</p> <p>Approved By  Thomas S. Harris - C.E.P. 12345</p>	<p>Standard Details STREET NAME SIGN Detail</p>	<p>Drawn By Butch Smith Scale N.T.S. Date October 30th 1996 File Number Std Det SSD0000 208</p>	 Page 208
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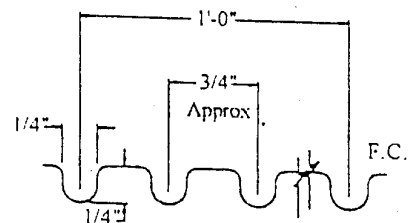




SECTION A - A




LIP DETAIL

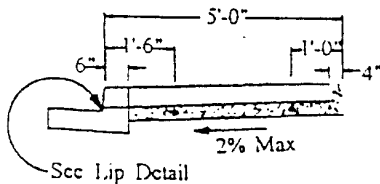
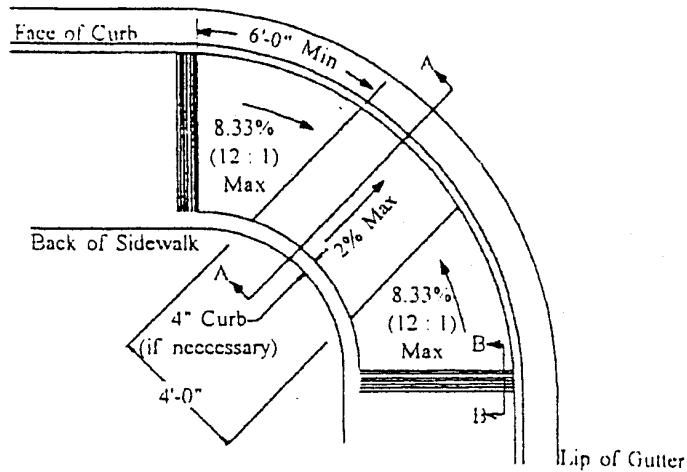


SECTION B - B

NOTE:

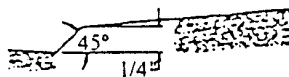
1. Design shall conform to these requirements except as otherwise approved by the Director of Engineering.
2. For subdivisions where sidewalks are not required for street improvements, curb depressions for curb ramps shall be omitted.
3. The surface of each curb ramp shall be slip resistant and shall be of contrasting finish from that of the adjacent sidewalk.
4. Type "B" or "C" ramp to be used in situations when 5'-0" minimum landing can not be obtained.
5. Sidewalk and ramp thickness shall be 4" of P.C.C. with two No. 4 rebar continuous over 4" of Class 2 A.B. compacted to 95%.
6. If curb exists, 1/2" dowels are required at 4'-0" on center between existing curb and new construction.

<p>CITY OF PETALUMA Department of Engineering 22 Bassett Street - Petaluma California 94952 707 778 4304 - Fax 707 778 4437</p> <p>Approved By <i>Thomas S. Hargis</i> Thomas S. Hargis - R.C. 22366</p>	<p>Standard CURB RAMP TYPE - B Detail</p>	<p>Drawn By Butch Smith Scale N.T.S. Date February 9th 1998 (Rev.) File Number Std. Det. SSD 0000 206 2 of 3</p>	 Page 206
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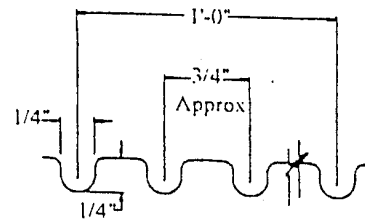


SECTION A - A

Lip bottom of the ramp shall have a 1/4" lip at 45°



LIP DETAIL



SECTION B - B

NOTE:

1. Design shall conform to these requirements except as otherwise approved by the Director of Engineering.
2. For subdivisions where sidewalks are not required for street improvements, curb depressions for curb ramps shall be omitted.
3. The surface of each curb ramp shall be slip resistant and shall be of contrasting finish from that of the adjacent sidewalk.
4. Type "B" or "C" ramp to be used in situations when 5'-0" minimum landing can not be obtained.
5. Sidewalk and ramp thickness shall be 4" P.C.C. with two No. 4 rebar continuous over 4" of Class 2 A.B. compacted to 95%.
6. If curb exists, 12" dowels are required at 4'-0" on center between existing curb and new construction.

CITY OF PETALUMA
Department of Engineering
22 Russell Street - Petaluma California 94952
707-778-4304 - Fax 707-778-4437

Approved By
Thomas S. Hargis
Thomas S. Hargis - R.C.E. # 22366

Standard
CURB RAMP
TYPE - C
Detail

Drawn by
Butch Smith

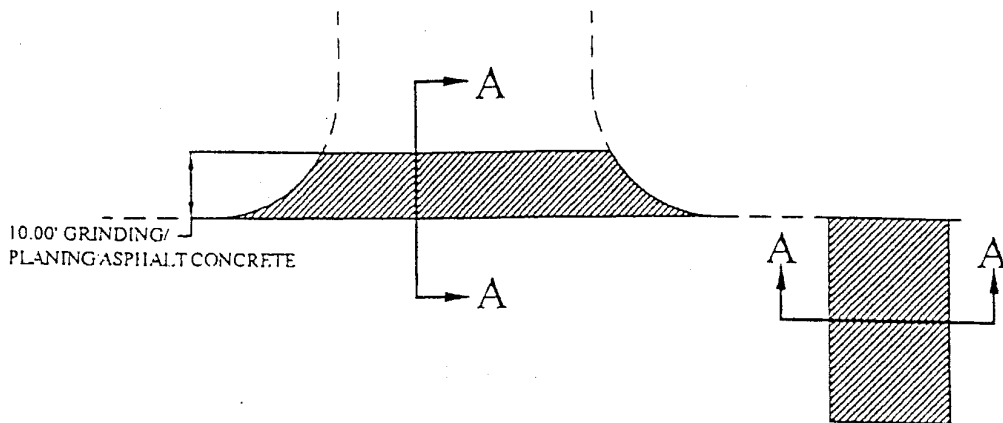
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N.T.S.

Date
February 9th 1998 (Rev.)

File Number
Std Det. SSD0000.206 3 of 3

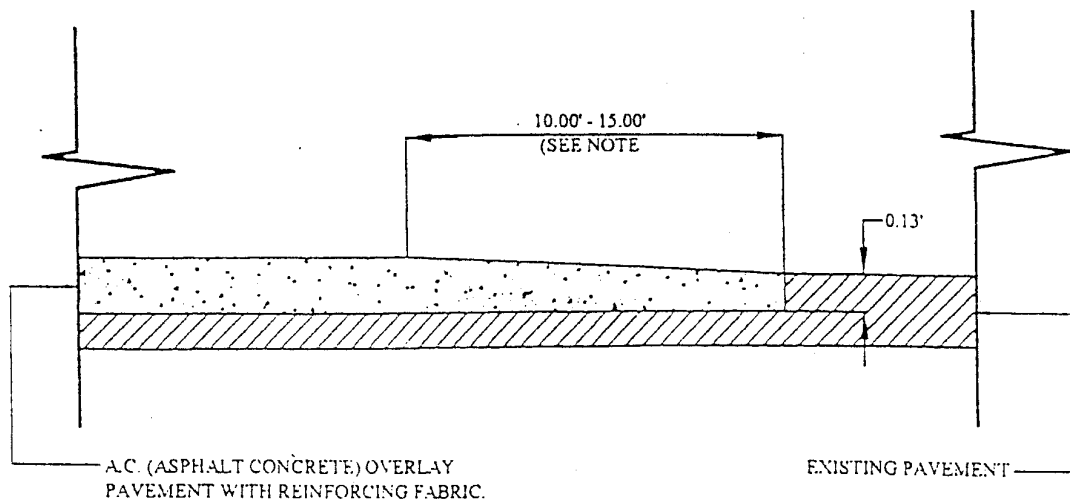


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SIDE STREET AND END OF OVERLAY CONFORM (TYPICAL)

SCALE: N.T.S.




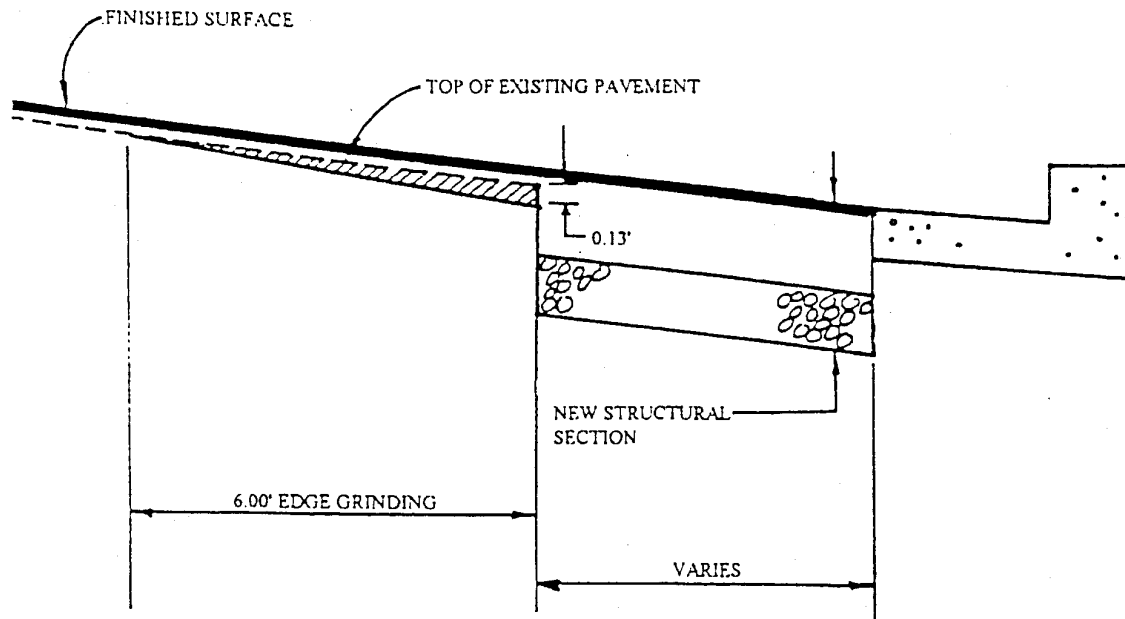
SECTION A-A

NOTE: COLD PLANING 10.00' SIDE STREET COLD PLANING
15.00' AT BEGINNING AND END OF OVERLAY
SCALE: N.T.S.

NOTE:

1. GRINDING / PLANING SHALL BE 0.13'
2. DESIGN SHALL CONFORM TO THESE REQUIREMENTS EXCEPT AS OTHERWISE APPROVED BY THE CITY ENGINEER.


<p>CITY OF PETALUMA Department of Engineering 22 Bassett Street - Petaluma California 94952 707 778 4304 - Fax 707 778 4437</p> <p>Approved By <i>Thomas S. Hargis</i> Thomas S. Hargis - R.C.E. 22360</p>	<p>Street Standard</p> <p>SIDE STREET AND END OF OVERLAY CONFORM</p>	<p>Drawn by Butch Smith</p> <p>Scale N. T. S.</p> <p>Date December 30th 1998</p> <p>File Number Std. Det. SSD0000.218 1 of 3</p>
		 Page 218.01

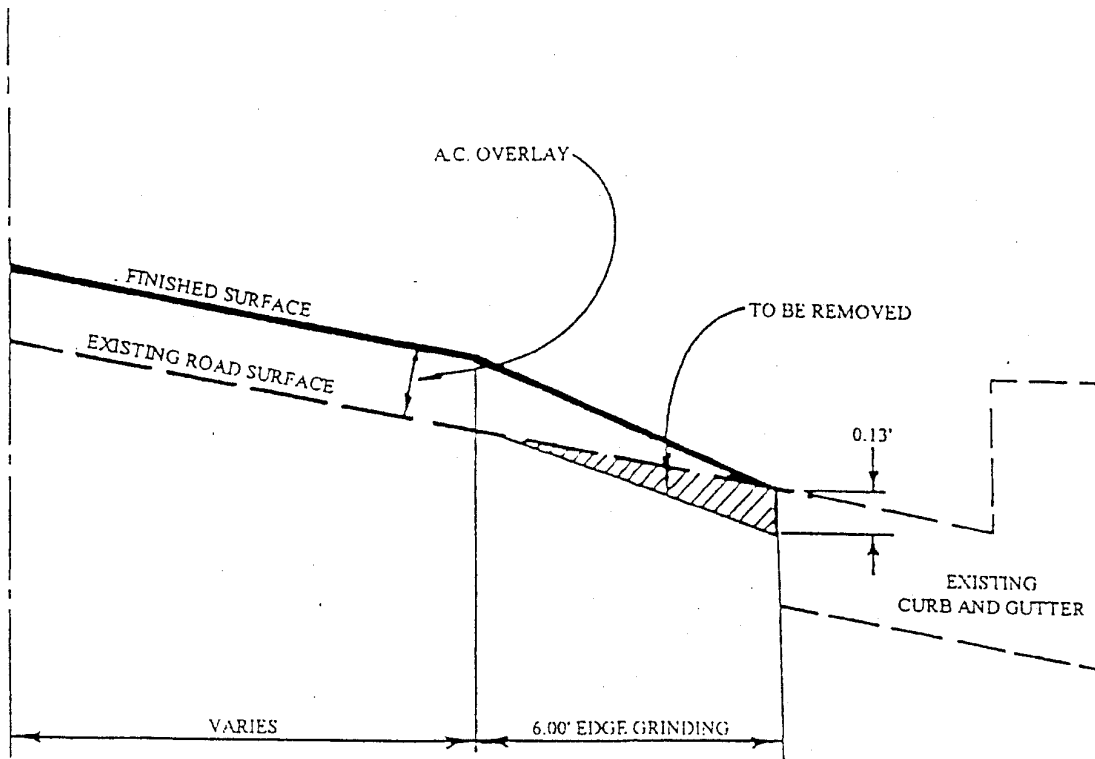


NOTE:

DESIGN SHALL CONFORM TO THESE REQUIREMENTS EXCEPT AS OTHERWISE APPROVED BY THE CITY ENGINEER.

FINISHED A.C. GRADE SHALL BE 0.02' ABOVE THE LIP OF GUTTER.

<p>CITY OF PETALUMA Department of Engineering 22 Bassett Street - Petaluma, California 94952 707 778 4304 - FAX 707 778 4437</p> <p>Approved By <i>Thomas S. Hargis</i> Thomas S. Hargis - R.C.E. 22766</p>	<p>Street Standard EDGE GRINDING AT NEW STRUCTURAL SECTION</p>	<p>Drawn By Butch Smith</p> <p>Scale N. T. S.</p> <p>Date December 30th 1998</p> <p>File Number Std. Det. SSD0000.218 2 of 3</p>	<p></p> <p>Page 218.02</p>
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NOTE:

DESIGN SHALL CONFORM TO THESE REQUIREMENTS EXCEPT AS OTHERWISE APPROVED BY THE CITY ENGINEER.

FINISHED A.C. GRADE SHALL BE 0.02' ABOVE THE LIP OF GUTTER.

CITY OF PETALUMA
Department of Engineering
22 Bassen Street • Petaluma California 94952
707 778 4304 • Fax 707 778 4437

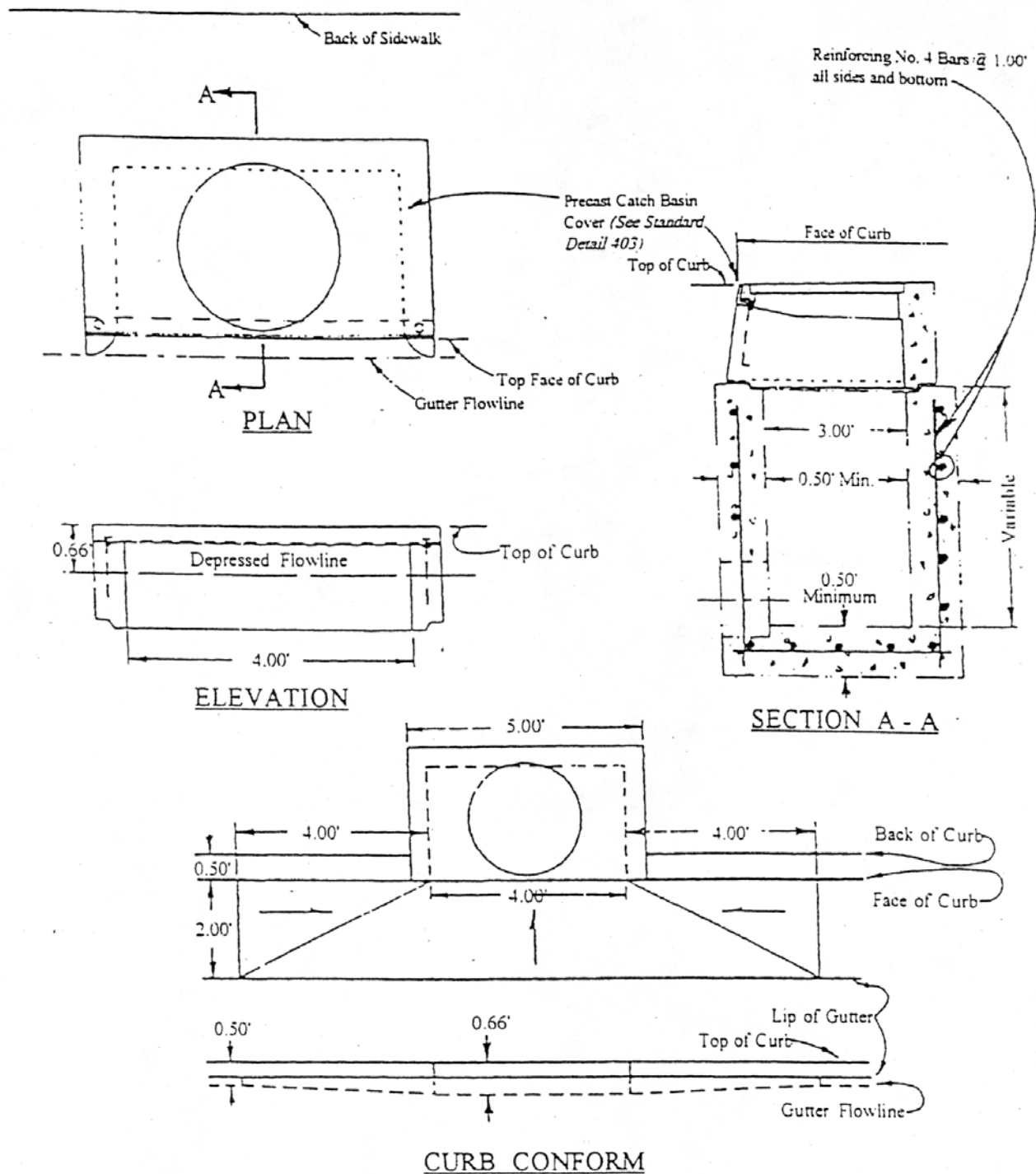
Approved By
Thomas S Hargis
Thomas S Hargis • R.C.E. 22366

Street Standard
EDGE GRINDING
AT LIP OF GUTTER WITH
OVERLAY SECTION

Drawn by
Butch Smith
Scale
N.T.S.
Date
December 30th 1998
File Number
Std. Det. SSD0000.218 3 of 3



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218.03



CITY OF PETALUMA

Department of Engineering

22 Bassett Street • Petaluma, California 94952
 Phone 707-4304 • Fax 707-4304

Approved By:

Thomas S. Hargis - R.C.E. 22366

Standard Type "A"
**CATCH
 BASIN**
 Storm Drain

Drawn By:

Butch Smith

Scale:

N. T. S.

Date:

December 2nd 1998 (Rev.)

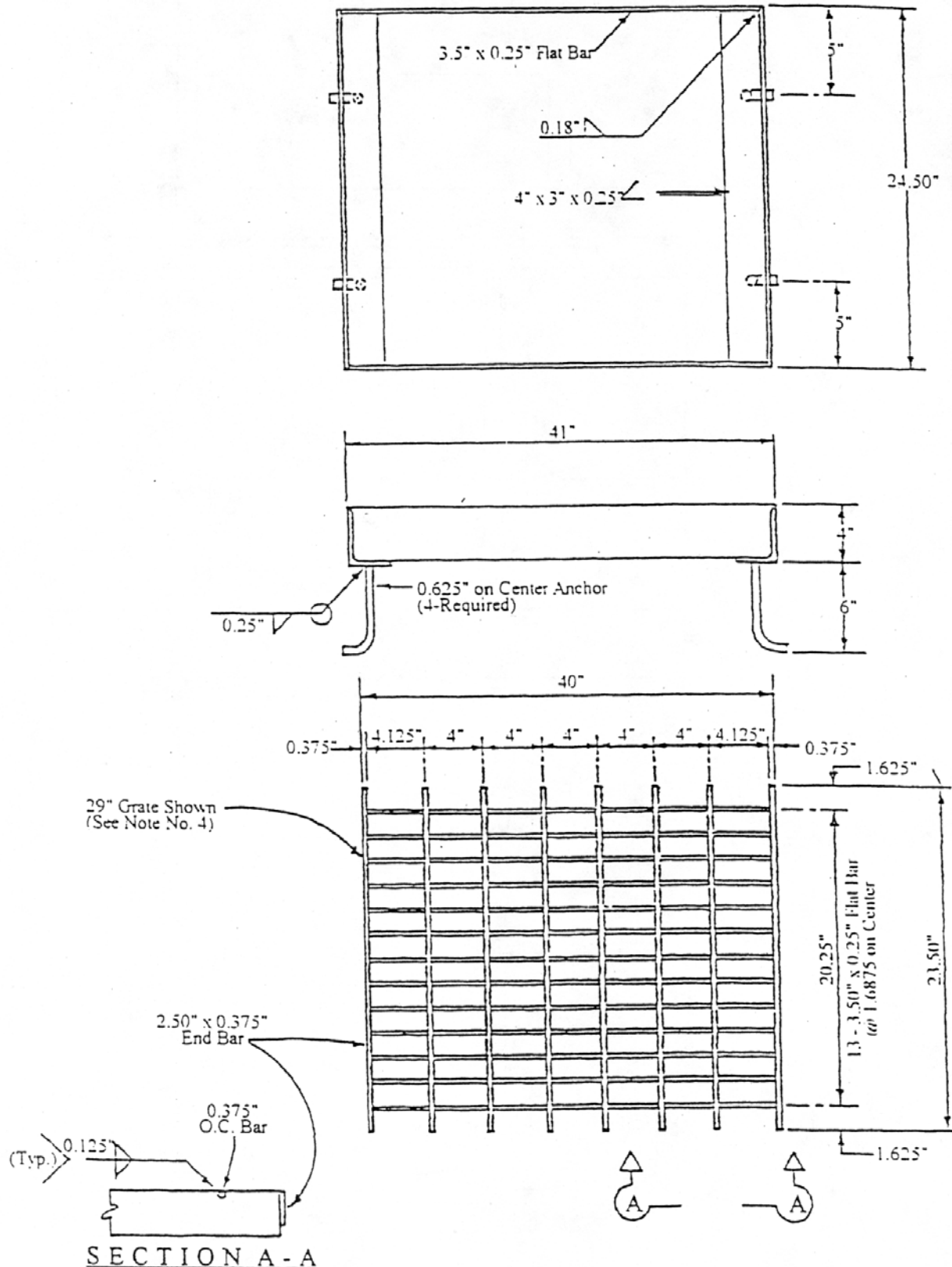
File Number:

Std. Det. SDS0000.401-A



Page:

401-A



- NOTE:
1. All steel shall be structural grade.
 2. All steel shall be "Hot Dipped Galvanized" after fabrication.
 3. Top and Bottom surfaces of grate shall be ground flush after welding.
 4. For 40" Grate use CALTRANS Standard Grate 24-12N or 24-10S.

CITY OF PETALUMA
Department of Engineering
22 Bassett Street - Petaluma California 94952
707-78-4304 - Fax 707-778-4437

Approved By:

Thomas S. Hargis - R.C.E. 22366

Standard
Type "E"
CATCH BASIN
GRATE
DETAIL

Drawn By:
Butch Smith

Scale:
N. T. S.

Date:
December 2nd 1998

File Number:
Std. Det. SDS0000.401-C

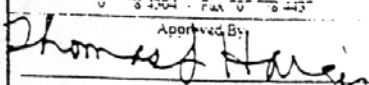



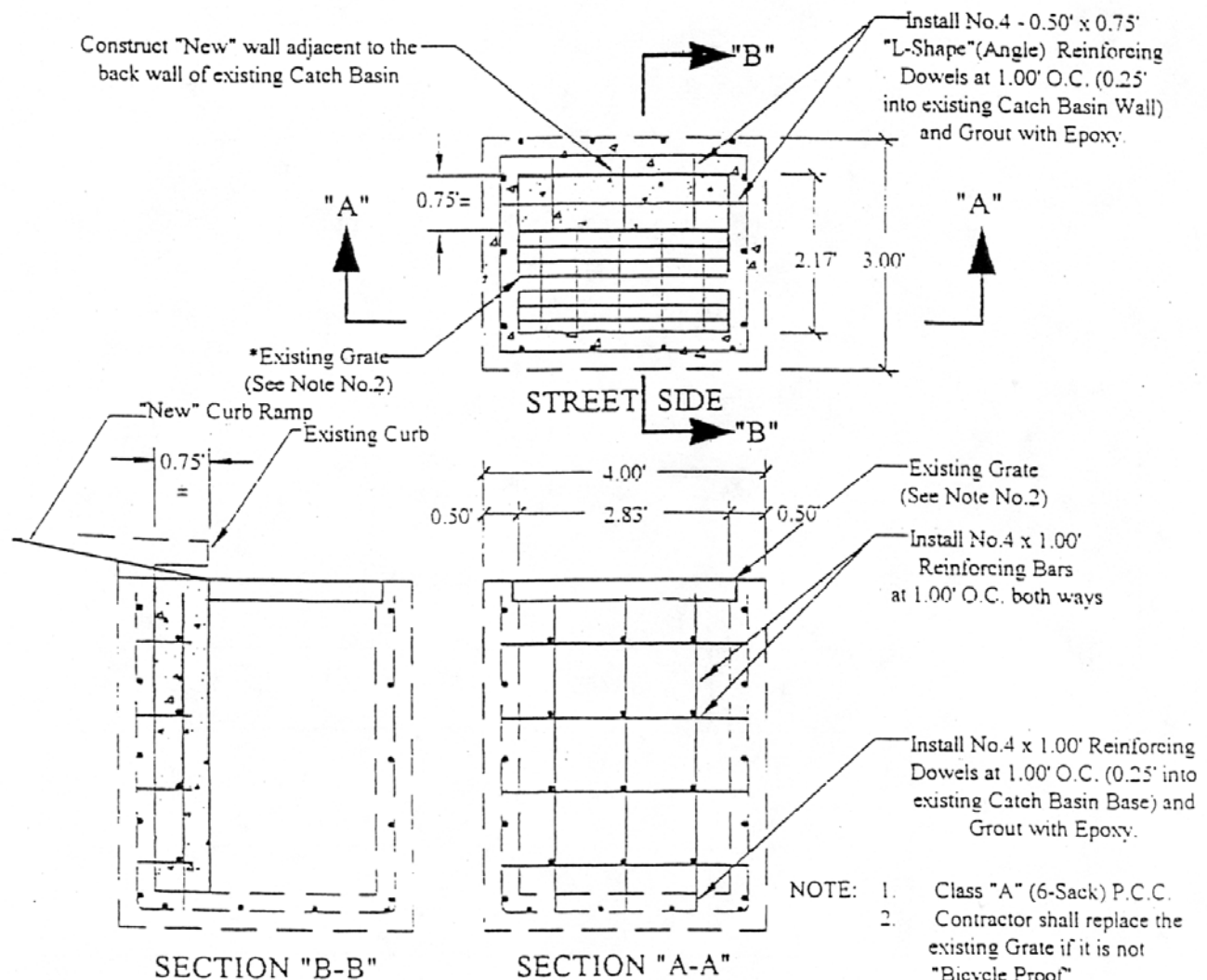
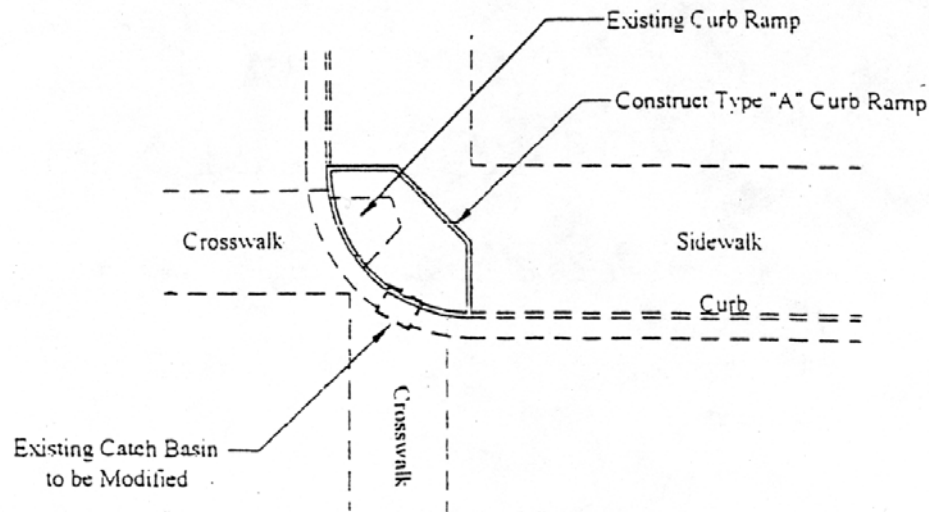
Page
401-C

CATCH BASIN AND DROP INLET NOTES

1. All concrete shall be *Class "A"* (6-sack mix) unless otherwise noted.
2. Base shall be placed against undisturbed earth. Sides may be formed or place against undisturbed earth.
3. Where conduits are encountered larger in diameter than the width of the wall through which they pass, the inside dimension of the walls normal to the direction of the pipe shall be increased to the outside diameter of the pipe.
4. Expansion joints shall be placed thru curb and sidewalk at both sides of catch basins and shall be limit of payment for curb and gutter. Unit prices for drainage structures shall include curb, gutter and sidewalk poured with drainage structure.
5. No concrete shall be placed prior to form and steel approval by the City Engineer.
6. See Standard Drawing Number 401-C for *Type "E" Catch Basin Grate Detail*.
7. Wall thickness and reinforcing shall be determined from the table below.
8. Place 0.75" weep holes as required by the *City Engineer*.
9. Equivalent precast structures may be substituted as approved by the *City Engineer*.

DEPTH	WALL THICKNESS	WALL REINFORCEMENT
Less than or equal to 8.00'	0.50'	No. 4 Rebar at 1.00' both ways
Over 8.0'	0.66'	No. 4 Rebar at 1.00' both ways

<p>CITY OF PETALUMA Department of Engineering 22 Bassett Street - Petaluma, California 94952 Phone 708-2504 - Fax 708-2437</p> <p>Approved By:  Thomas S. Hargis - R.C.E. 22366</p>	<p>CATCH BASIN AND DROP INLET NOTES</p>	<p>Drawn By Butch Smith</p> <p>Scale N. T. S.</p> <p>Date August 13th 1999 (Rev.)</p> <p>File Number Std. Det. SDS0000.401-D</p>		<p>Page 401-D</p>
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CITY OF PETALUMA
Department of Engineering
22 Bassett Street - Petaluma California 94952
Tel: 707.430.4304 - Fax: 707.776.4437

Approved By:

Thomas S. Hargis
Thomas S. Hargis - R.C.E. 22366

Standard
Modification of Existing
Catch Basin
to Accomodate the Installation
of "New" Curb Ramp

Drawn by:
Butch Smith

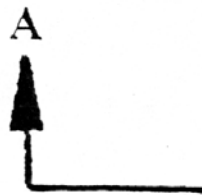
Scale:
N. T. S.

Date:
August 2nd 1999

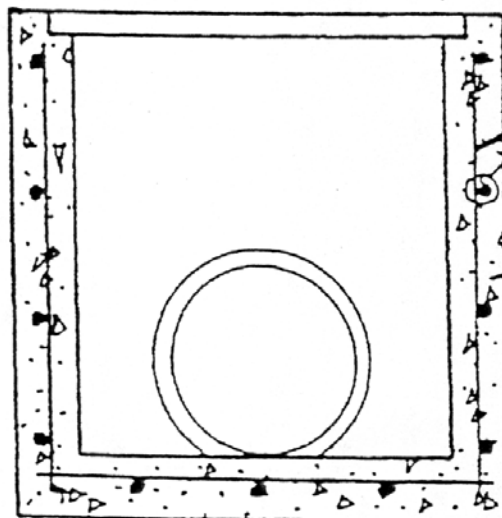
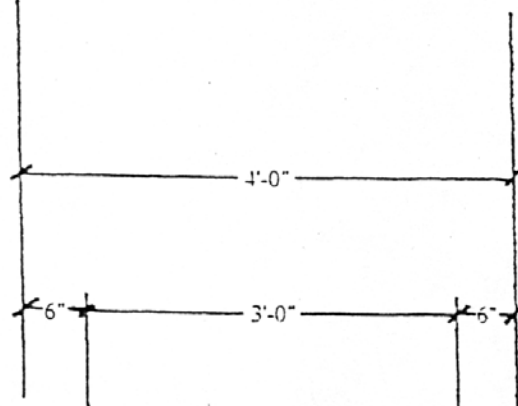
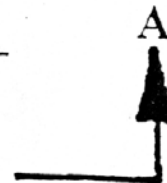
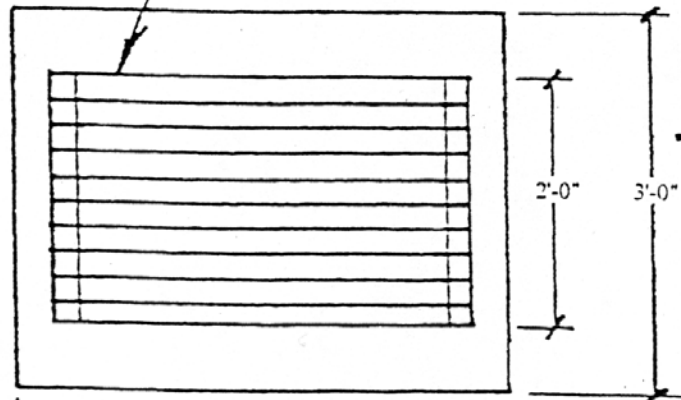
File Number:
Std. Det. SDS0000.401-E



Page:
401-E



Grate shall be bicycle proof
CALTRANS Type 18-9X



Reinforcing No. 4 Bars at
12" all side and bottom.

See storm drain specifications
for concrete requirements

SECTION "A-A"

CITY OF PETALUMA
Department of Engineering

22 Easton Street - Petaluma California 94952
707 778 4304 - Fax 707 778 4437

Approved By

Thomas S. Hargis
Thomas S. Hargis - R.C.E. 22766

Standard
**DROP
INLET**
Storm Drain

Drawn by
Butch Smith

Scale
N. T. S.

Date
February 9th 1998 (Rev.)

File Number
Std. Det. SDS0000.407



Page
407

Neat cut tack edges and joints

See Note No. 4

3" A.C. - 1 lift

Finish Grade

6"

Class 2 A.B.
95% R.C.

30" See Note No. 3

Trench
Backfill
90% R.C.

TYPE "A"

Class 2 A.B.
95% R.C.

12" See Note No. 3

Trench
Backfill
90% R.C.

TYPE "B"

(Shoulder Areas)

Natural Ground

Subgrade

6"

Trench
Backfill
90% R.C.

TYPE "C"

(Street Under Construction)

Native
Material
Removed from
upper 30"
90% R.C.

30" Planting Area

Trench
Backfill
90% R.C.

TYPE "D"

(Public Utility Easement)
(Outside Street Area)

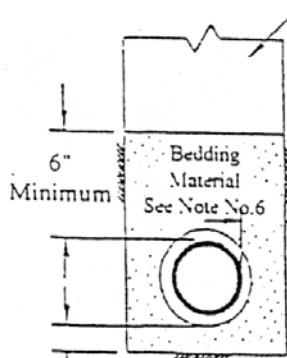
Native
Material
Removed from
upper 30"
90% R.C.

Native
Material
8% R.C.

TYPE "E"

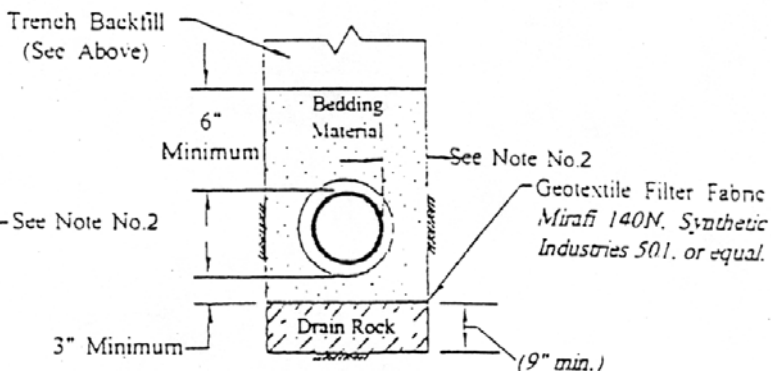
(Public Utility Easement)
(Undeveloped Areas)

PIPE BEDDING



3" Minimum
See Note No. 1

STABLE TRENCH



UNSTABLE TRENCH

NOTES:

1. 1/4 Pipe outside diameter minimum when excavation is in rocky ground
2. Pipe diameter 18" or less: 6" minimum, 9" maximum. Pipe diameter greater than 18": 6" minimum, 12" maximum. (Plus Shield Allowance)
3. The *Minimum* street structural section shall be 3" A.C. on 30" Class 2 A.B. or as shown on plans, whichever is higher.
4. Neatly cut pavement 6" from edge of trench.
5. Different trench sections may be required by the City.
6. Bedding Material is A.S.B. or equivalent and shall be compacted to 90% R.C.
7. Trench backfill shall be Class 1 A.S.B.
8. At the contractor's option, controlled density fill (CDF) max. No. 1500 manufactured by Shamrock Materials Inc. may be used in lieu of Class 2 A.B. and/or trench backfill.

CITY OF PETALUMA
Department of Engineering

22 Bassett Street - Petaluma California 94952
"0" 3-4304 - Fax "0" 3-4313

Approved By:

Thomas S. Hargis
Thomas S. Hargis - R.C.E. 22366

Standard
TRENCH
DETAILS
Storm Drain

Drawn By

Butch Smith

Scale:

N. T. S.

Date:

April 14th 1999 (Rev.)

File Number

Std. Det. SDS0000.408



Page

408

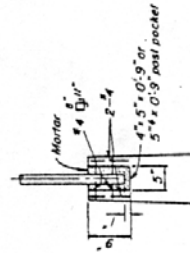


1. Maximum distance between turnbuckles shall be 200'±.
2. Intermediate turnbuckles to be placed in adjacent spans.
3. Cable shall not be spliced between intermediate turnbuckles and end posts.
4. All posts, cable and hardware to be galvanized.
5. Posts to be vertical.
6. Alignment of holes in posts may vary to conform to slope of top of retaining wall.
7. The Contractor shall verify all dependent dimensions in the field before ordering or fabricating any material.
8. Alternative details may be submitted by the Contractor for approval by the Engineer.
9. Line posts shall be braced horizontally and braced diagonally in both directions at intervals not to exceed 1000'.
10. Post pockets to be centered in top of wall.
11. Typical and spans, braced in both directions, shall be constructed at changes in line where the angle of deflection is 15° or more.
12. Provide turnbuckles at all cable loops.

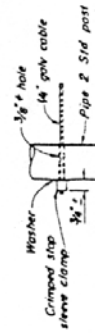
RETAINING WALL (With Gutter)
NEW CONSTRUCTION



ALTERNATIVE CABLE CONNECTION

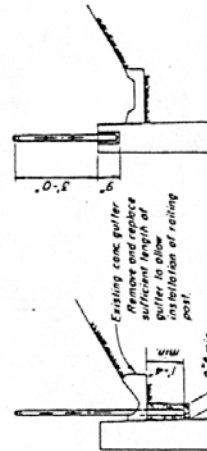


POST POCKET



ALTERNATIVE DEAD END ANCHORAGE

RETAINING WALL (With Gutter)
EXISTING

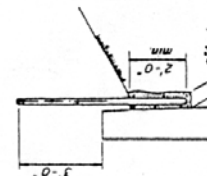
ELEVATION

NEW CONSTRUCTION

SECTION C-C

RETAINING WALL (Without Gutter)
EXISTING

EXISTING



SYNOPSIS

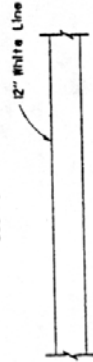
SECTION A-A

POST MILE	ROUTE	SECTION	DATE
101.1	101	101.1	101.1

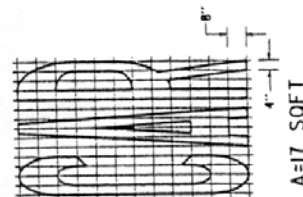
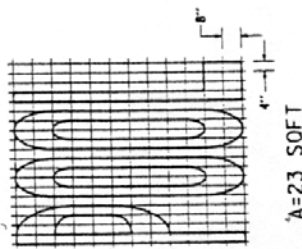
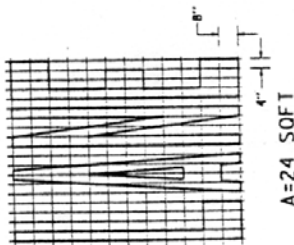
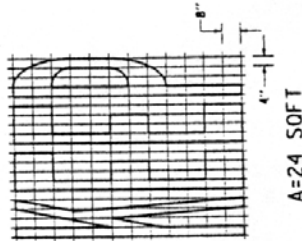
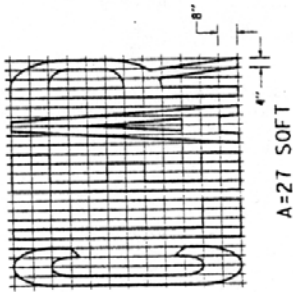
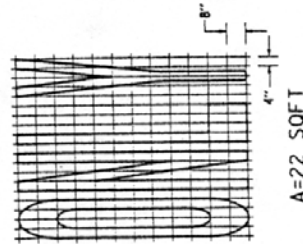
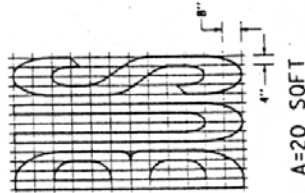
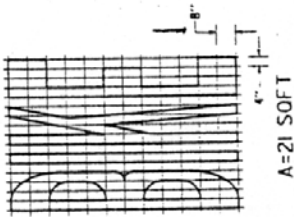
REGISTERED CIVIL ENGINEER
 JULY 1, 1992
 PLANS APPROVAL DATE

CROSSWALK AND LIMIT LINE

See Note 5



WORD MARKINGS			
ITEM	SOFT	ITEM	SOFT
LANE	24	NO	5
POOL	23	BIKE	21
CAR	17	BUS	20
CLEAR	27	ONLY	22
KEEP	24		



NOTES.

- (1) If a message consists of more than one word, it should read "Up...ie., the first word should be nearest the driver.
- (2) The space between words should be at least four times the height of the characters for low speed roads, but not more than ten times the height of the characters. The space may be reduced appropriately where there is limited space because of local conditions.
- (3) Minor variations in dimensions may be accepted by the Engineer.
- (4) Portions of a letter, number or symbol may be separated by connecting segments not to exceed 2" in width.
- (5) Crosswalks contiguous to school grounds are to be 12" yellow lines in place of 12" white shown.

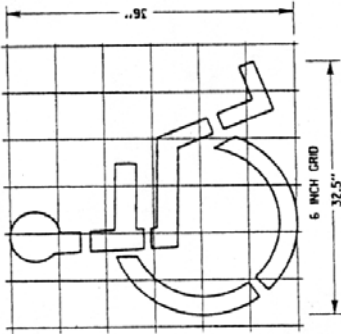
STATE OF CALIFORNIA
 DEPARTMENT OF TRANSPORTATION

PAVEMENT MARKINGS
 WORDS AND CROSSWALKS

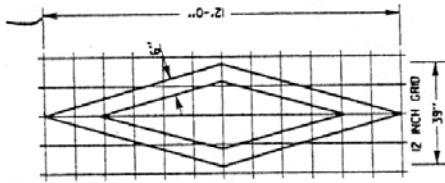
NO SCALE

A24E

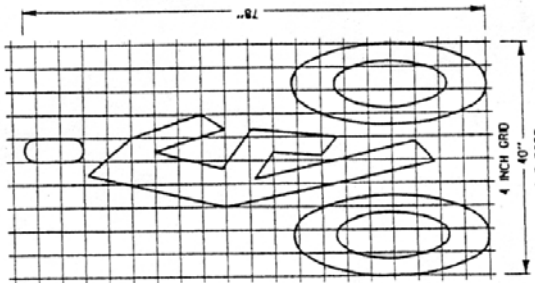
POST MILE	SECTION	DATE
TOTAL PROJECT	ROUTE	DATE
REGISTERED CIVIL ENGINEER July 1, 1992 PLANS APPROVAL DATE		



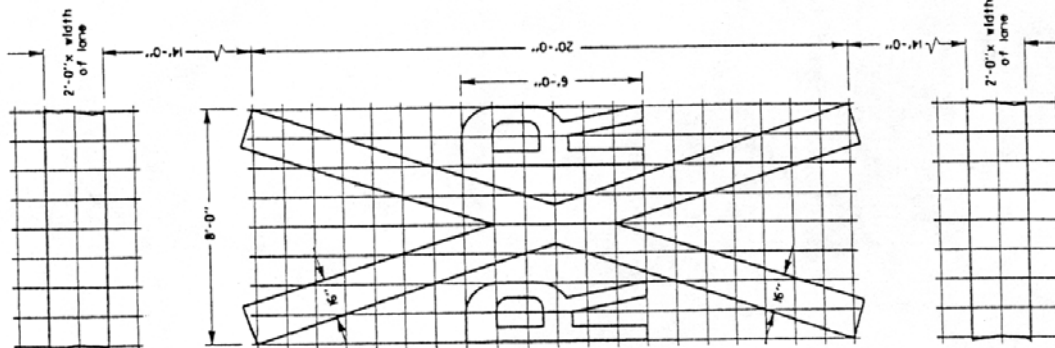
HANDICAPPED PARKING SYMBOL



DIAMOND SYMBOL

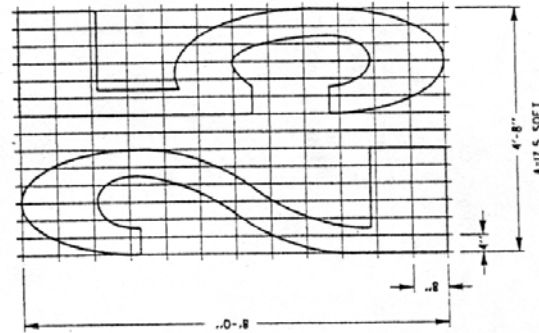
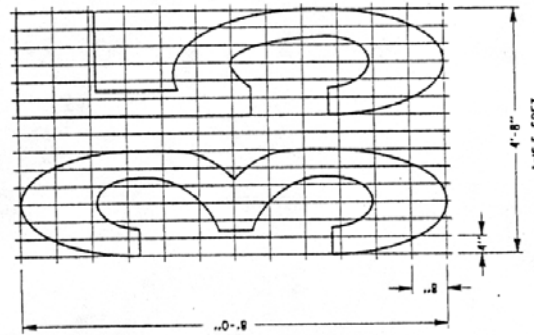
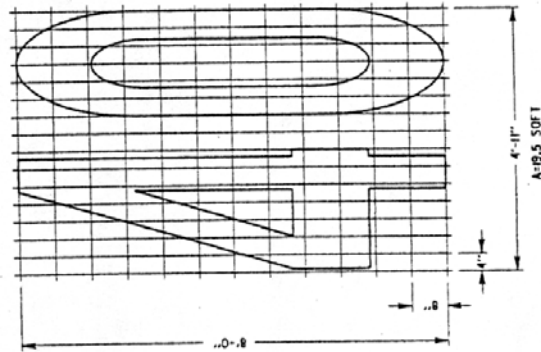


BIKE LANE SYMBOL



RAILROAD CROSSING SYMBOL

*10 SOFT DOES NOT INCLUDE THE 2'-0" VARIABLE WIDTH TRANSVERSE LINES.



NUMERALS

NOTE

MINOR VARIATIONS IN DIMENSIONS
MAY BE ACCEPTED BY THE ENGINEER.

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

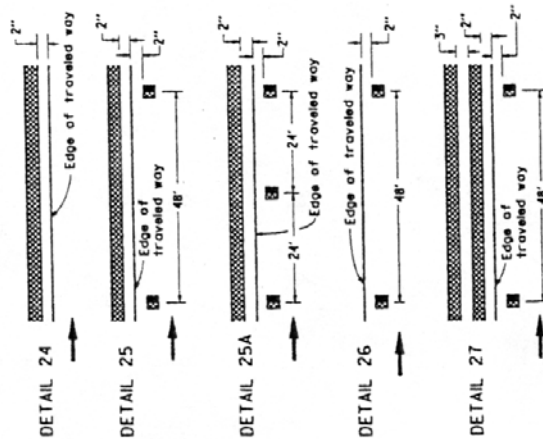
PAVEMENT MARKINGS
SYMBOLS AND NUMERALS

NO SCALE

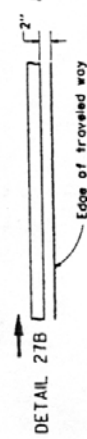
A24C

POST-MILE TOTAL	15.24
ROUTE	101
COUNTY	LOS ANGELES
PROJECT	101-101
DATE	1992
DESIGNED BY	W. J. L. L. L.
CHECKED BY	W. J. L. L. L.
APPROVED BY	W. J. L. L. L.
DATE	1992
PLANS	101-101

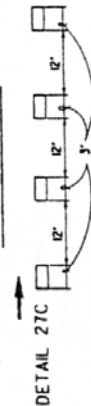
LEFT EDGELINES
(Divided Highways)



RIGHT EDGELINE



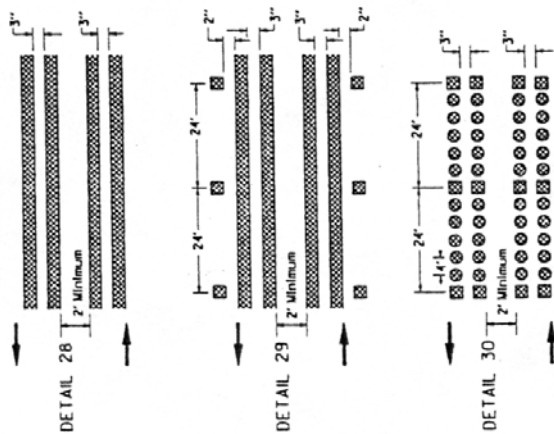
RIGHT EDGELINE EXTENSION THROUGH INTERSECTIONS



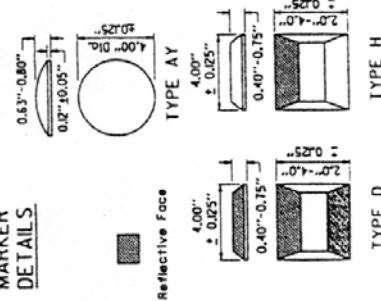
LEGEND

- MARKERS**
- TYPE D Two-way Yellow Reflective
 - TYPE AY Yellow Non-reflective
 - TYPE H One-way Yellow Reflective
- LINE**
- 4" White
 - 4" Yellow
- Direction of Travel

MEDIAN ISLANDS

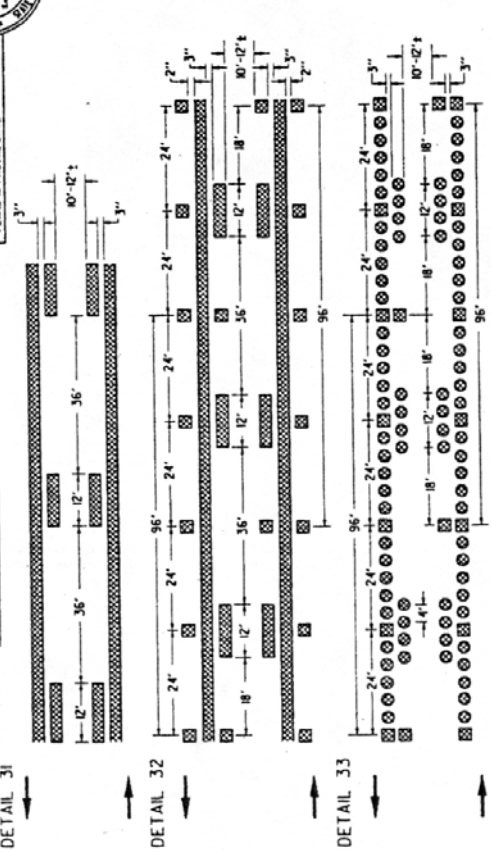


MARKER DETAILS

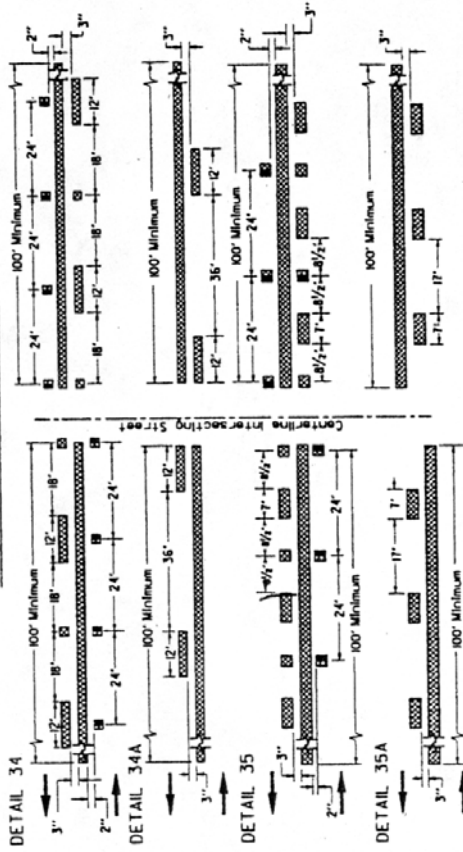


- NOTES**
- Minimum projected area of reflective face = 100 square inch
 - Reflective marker need not be rectangular
 - Detail 27A deleted

TWO-WAY LEFT TURN LANES



INTERSECTION TREATMENTS

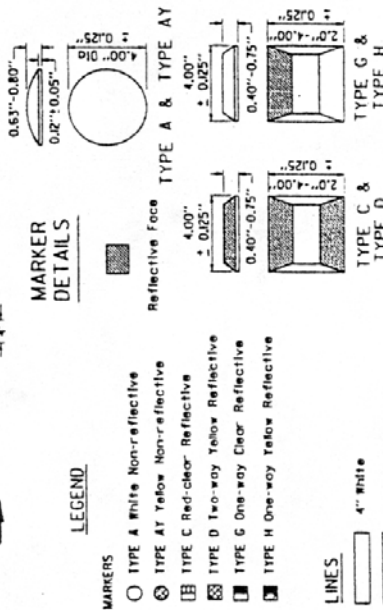
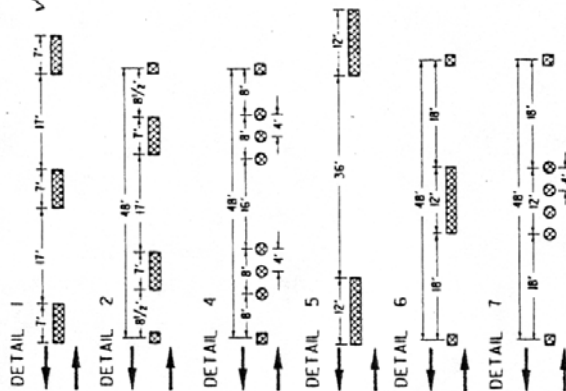


STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
PAVEMENT MARKERS AND TRAFFIC LINES TYPICAL DETAILS
A20B
NO SCALE

POST	COUNTY	ROUTE	TOTAL PROJECT	NO. SHEETS

REGISTERED CIVIL ENGINEER
 July 1, 1992
 PLANS APPROVAL DATE

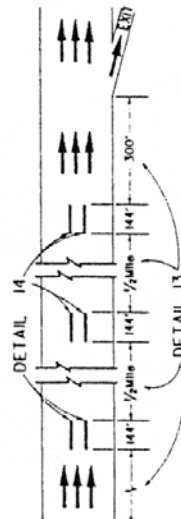
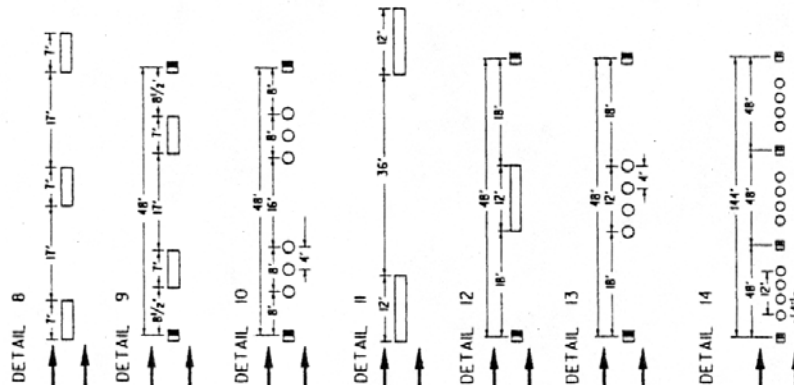
CENTERLINES 12 LANE HIGHWAYS



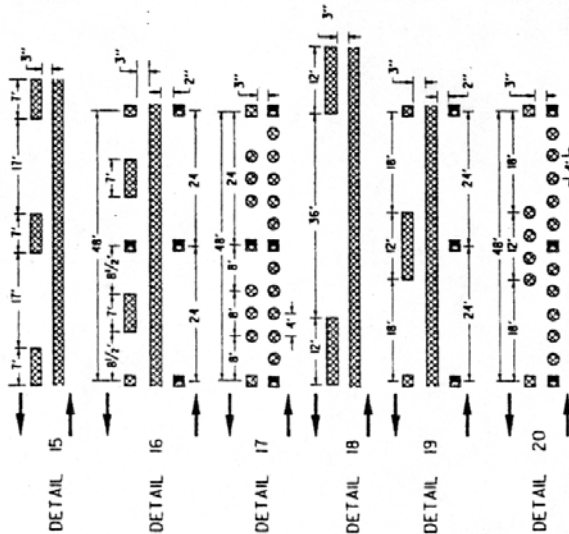
NOTES

- Minimum projected area of reflective face = 1.00 square inch
- Reflective markers need not be rectangular
- Detail 3 deleted

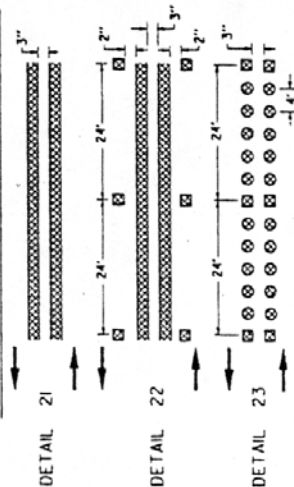
LANELINES (MULTILANE HIGHWAYS)



NO PASSING ZONES-ONE DIRECTION



NO PASSING ZONES-TWO DIRECTIONS



PAVEMENT MARKERS AND TRAFFIC LINES TYPICAL DETAILS NO SCALE

A20A

POLICY

W10



W10-2

**RAILROAD ADVANCE WARNING
CROSSROAD SIGN**

The Railroad Advance Warning - Crossroad sign (W10) may be used in advance of a crossroad intersection where a railroad runs parallel to the highway and the separation between the railroad and the highway is 30 m or less. If the separation distance is more than 30 m, a W47 sign should be installed in advance of the railroad and the W10 would not be necessary.

See Figures 6-40, 6-41 and 6-42 for typical examples of railroad grade crossing signing and pavement marking.

W10A



W10-3

**RAILROAD ADVANCE WARNING
SIDEROAD SIGN**

The Railroad Advance Warning - Sideroad sign (W10A) may be used in advance of a sideroad intersection where a railroad runs parallel to the highway and the separation between the railroad and the highway is 30 m or less. If the separation distance is more than 30 m, a W47 sign should be installed in advance of the railroad and the W10A sign would not be necessary.

See Figures 6-40, 6-41 and 6-42 for typical examples of railroad grade crossing signing and pavement marking.

W10B



W10-4

**RAILROAD ADVANCE WARNING
"T" INTERSECTION SIGN**

The Railroad Advance Warning - "T" Intersection sign (W10B) may be used in advance of a crossroad intersection where a railroad runs parallel to the highway and the separation between the railroad and the highway is 30 m or less. If the separation distance is more than 30 m, a W47 sign should be installed in advance of the railroad and the W10B sign would not be necessary.

See Figures 6-40, 6-41 and 6-42 for typical examples of railroad grade crossing signing and pavement marking.